Africa RISING Baseline Evaluation Survey (ARBES) report for Malawi

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Produced by International Food Policy Research Institute

Published by International Institute of Tropical Agriculture/ International Food Policy Research Institute

May 2016

www.africa-rising.net

The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment. http://africa-rising.net/

This document was made possible with support from the American people delivered through the United States Agency for International Development (USAID) as part of the US Government's Feed the Future Initiative. The contents are the responsibility of the producing organization and do not necessarily reflect the opinion of USAID or the U.S. Government.

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List of Accronyms

Africa RISING	Africa Research in Sustainable Intensification for the Next Generation
FtF	Feed the Future
MARBES	Malawi Africa RISING Baseline Evaluation Survey
BMI	Body Mass Index
IFPRI	International Food Policy Research Institute
MWK	Malawian Kwacha
M&E	Monitoring and Evaluation
USAID	United States Agency for International Development

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Acknowledgements

This report is prepared by Apurba Shee (Associate Research Fellow). The IFPRI M&E team Carlo Azzarri (Research Fellow and team leader), Beliyou Haile (Associate Research Fellow), Maria Comanescu (Programmer), and Cleo Roberts (Senor Research Assistant) oversaw the planning and implementation of the data collection and subsequent data cleaning. A local survey firm, Invest in Knowledge Initiative (IKI), assisted with the coordination and data collection. We are especially grateful to Denview Magalasi and Richard Kusseni (IKI) for their hard work during the field work. Pascale Schnitzer (Independent Consultant) provided support with field supervision and Ainsley Charles (Independent Consultant) supported the M&E team during the early stages of the preparation. Zhe Guo (GIS Specialist) oversaw the site characterization and stratification exercise. Regis Chikowo (MSU) provided invaluable comments during the planning and implementation of the survey and identification of control villages. Ivy Romero (Administrative Coordinator) provided excellent assistance in various aspects of the management and administration of the survey. We are grateful to Orlando Ortega and his colleagues at Westat for generously loaning us 30 tablets and accessories to aid with electronic data collection.

Executive Summary

The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING - AR) in Malawi is a research-for-development project supported by the United States Agency for International Development (USAID) as part of the U.S. Government's Feed the Future (FtF) initiative. The main objective of the project is to create opportunities through action research and development for smallholder farm households to move out of hunger and poverty through sustainably intensified (SI) farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

This report presents overall summaries of Malawi Africa RISING Baseline Evaluation Survey (MARBES) data that cover 1,149 households in Africa RISING areas in central region of Malawi covering two districts (Dedza and Ntcheu). Following a description of survey design and tools, the report presents main findings in the form of cross tabulation, tables and graphs for both household and community level survey data. The summaries of the household data include demography, agricultural land characteristics, production and inputs, storage facility, livestock ownership, dwelling characteristics, agricultural related shocks, and children and women anthropometry. The community data summary covers community demography, access to basic services, labor in agriculture, agriculture related problems and solutions, land use and major crops, migration, availability of water resources, and prevalence of shocks.

Malawi Africa RISING follows an approach called "mother and baby trials" and the participating farmers are identified as early adopters, progressive and model farmers, they are usually not a representative farmer. Under such circumstances the program evaluation of Malawi AR faces challenges in terms of identification, external validity and spillover effect of technology. To address this challenge, IFPRI's M&E team adopted a Quasi-Randomized Control Trial which is an empirical causal impact evaluation method similar to RCT, but lacks element of random assignment of the technologies to the treatment group.

Malawi AR target districts were predetermined as part of the Feed the Future initiative and the beneficiary villages are selected by AR project implementers. The M&E team selected the control sites that were in the same development domain (agro-ecology) with the selected action sites to produce statistically valid and generalizable estimates of program impact. Also to prevent contamination the team selected control sites physically isolated from the action sites. After identification of action households by AR implementers, IFPRI M&E team sampled villages such that they fall within each homogeneous agro-ecology areas as AR beneficiary sections. Altogether 26 control villages were sampled from within identified control area using probability proportional to size. Finally, random sampling of households from control and AR villages (AR non-beneficiary households) were done. So the survey households are categorized as three research groups; AR beneficiary, non-beneficiary and control households. The data summary presented in this report analyzes the main variables of interest by these three research groups.

MARBES employs two structured survey tools, namely the household questionnaire and the community questionnaire. Overall, the household survey questionnaire covers 22 modules whereas community survey questionnaire contains 9 modules. Furthermore, due the complexity of the survey instruments and the need for minimizing possible sources of measurement error

(e.g. data entry errors, non-sampling error more in general), the main technique for data collection was a Computer Assisted Personal Interviewing (CAPI) using tablets.

Both household and community survey data analysis reveal that crop production is the primary economic activity of the surveyed households and communities. Average household level land size in the sample is about 2.7 hectares but the cultivable land holding is about one hectare per household. The main crops cultivated in the area are maize, groundnut, soybean and beans. Most households practice mixed farming with prevalence of chicken raising in the households. The findings from the community interviews in all 54 villages confirm the general findings out of household survey data. Total cultivable land in average community is 45% which confirms the average percentage of cultivable land from the household survey data. The community survey data also confirms that the main crops in the area are maize, groundnut, soybean and beans. In terms of the most serious shock to agriculture, community data reinforce that the shortage of inputs and their high prices cause the most serious negative shock to agriculture.

1 Malawi Africa RISING Baseline Evaluation Survey (MARBES)

1.1 Evaluation Design

Malawi Africa Research in Sustainable Intensification for the Next Generation (Africa RISING or AR) program is an agricultural research for development program that began in 2012 to promote sustainable intensification of agriculture among smallholder farmers. The main aim of the program is to promote system based agricultural technologies and practices that are tailored to smallholder farmers' local conditions. Farmers participating in the program from selected sites are offered a menu of improved technologies and management practices. Malawi AR operates in two districts, Dedza and Ntcheu and follows an approach called "mother and baby trials" (MBTs). MBTs are adaptive research platforms created to identify and disseminate successful practices with the active participation of farmers. The mother trials are conducted with lead farmers selected from targeted villages that are convenient for exposure visits by other farmers. The mother farmers actively participate in interactive, researcher-designed, scientific demonstration trials of varied agricultural technologies. Other selected lead farmers are then given exposure visits to mother trials and are allowed to select technologies that are suitable for them. These are called baby trials. The mother and baby trial farmers are self-selected farmers who are willing to devote plots of certain size for replication of trials. Various system based technologies are explored within MBTs which include intercropping of different hybrid maize with improved groundnut, soybean, cowpea, pigeon pea and bean varieties with different doses of NPK fertilizer (List of varieties are provided in the appendix table A1).

The above mentioned experimental design of MBTs pose a challenge on socioeconomic evaluation of the program in terms of measuring its impact on participating households and on scaling up the technology to a wider population. Ideally, Randomized Control Trial (RCT) design is preferred to evaluate the impact of such technologies. However, since the participating farmers in Malawi AR program are identified as early adopters, progressive and model farmers, they are usually not a representative farmer. Under such circumstances the program evaluation of Malawi AR faces challenges in terms of identification, external validity and spillover effect of technology. Identifying the program impact by comparing participants with non-participants may reflect not only the impact of the technologies but also the innate difference between participants and non-participants. When the participants are not selected randomly, the systematic difference between the participants and non-participants can influence the program impact. In case of Malawi AR, the program impact may be overestimated if the outcome variables such as crop productivity, income etc. are systematically better for beneficiaries compared to non-beneficiaries. In terms of external validity, the non-random participation of farmers in AR program may not provide unbiased and representative impact of the targeted population and hence pose challenges on program scaling up. For example, the program can provide strong impact on selected group of progressive farmers in high potential area whereas the same program can yield low impact if the group of farmers are selected from low potential area. Finally, technology spillover effect can complicate the program evaluation by spreading the impact of technology to non-treated households. That is why evaluation design should be such that it can disentangle the technology effect from the learning effect.

To address the three challenges mentioned above IFPRI's M&E team adopted a Quasi-Randomized Control Trial (QRCT). A QRCT is an empirical causal impact evaluation method similar to RCT, but lacks element of random assignment of the technologies to the treatment group. The Malawi AR evaluation design involves the following sequential stages:

1) Malawi AR target districts (Dedza and Ntcheu) were predetermined as part of the Feed the Future initiative and the beneficiary sections and villages within the designated EPAs (Extension Planning Areas) are selected by AR project implementers. The M&E team selected the control (counterfactual) sites that were in the same development domain (agro-ecology) with the selected action (beneficiary) sites to produce statistically valid and generalizable estimates of program impact. Also to prevent contamination the team selected control sites physically isolated from the action sites. In order to stratify and characterize the target areas by agro-ecology we reviewed various biophysical and socio-economic data layers (such as population density, elevation, precipitation, market access, slope, maize harvested area, length of growing period, farming systems, and temperature) (see Table A2 in the appendix for different data layers and their sources). Among these data layers, elevation and temperature adjusted rainfall deemed as the two best proxies for capturing variability in the biophysical characteristics, and are then used in final classification process (see appendix Figure A1). Within the homogenous agro-ecology areas two beneficiary EPAs per district (Golomoti and Linthipe EPAs in Dedza and Kandeu and Nsipe EPAs in Ntcheu) are selected by the AR project implementers. The villages within each EPAs were selected by the project implementers and the households in a village were selected through community meetings.
2) After identification of action households by AR implementers, IFPRI M&E team sampled four control sections (Mtakataka and Thete in Dedza and Sitolo and Mwalaoyera in Ntcheu) such that they fall within each homogeneous agro-ecology areas as AR beneficiary sections.
3) IFPRI M&E team then sampled 26 control villages from within identified control sections using probability proportional to size.
4) Finally, random sampling of households from control and AR villages (AR non-beneficiary households) were done. Control households would allow us to identify valid counterfactual to estimate program impact while comparison of observed outcomes for AR non-beneficiaries and control households would provide estimates of potential spillover. Given the non-random selection of AR villages, comparison of AR non-beneficiary households and control households would also capture the effect of potential targeting bias.

Sampling design for QRCT

While the beneficiary sample is pre-determined, the size of non-beneficiary and control samples was guided by power calculations based on maize yield data from the 2011 Malawi Integrated Household Survey[1]. Baseline maize yield was estimated at 1049 kilogram per hectare (kg/ha) and the power calculation was based on several assumption: a 20% increase in average maize yield (to 1259 kg/ha) between baseline and follow up, a 0.1 correlation in maize yield between

[1] Third Malawi Integrated Household Survey (http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTLSMS/0,,contentMDK:23152072~menuPK:4196952~pagePK:64168445~piPK:64168309~theSitePK:3358997,00.html)

baseline and follow up, and an intra-cluster correlation of 0.05. A sample size of 1260 households (20 households per village and about 60 villages) was determined to achieve 80% chance that our design identifies a statistically significant impact. Sensitivity of power calculation was performed using different parameter estimates and ultimately the final sample size was determined, also by considering budget constraints. Detailed socioeconomic data were collected from three groups of households during August – October 2013.

Beneficiary households - 400 program beneficiary households (as of July 2013) were included. Names and identifying information about beneficiaries were obtained from Malawi Africa RISING research scientists. This group is referred to as "AR beneficiary" thereafter.

Non-beneficiary households - In order to sample the target 200 non-beneficiary households, and given that action villages were predetermined, we obtained a household list for all the 24 action villages from District Agricultural Offices. The target sample of 200 was divided into the four action Sections (Mposa and Golomoti Center Sections in Dedza and Kampanje and Mpamadzi Sections in Ntcheu) proportional to the share of each Section's population of the total population for the four Sections. Then a fixed number of household were randomly sampled from each of the action villages using simple random sampling. This group is referred to as "Non-beneficiary" thereafter.

Control households - From within the geographic area that was identified to serve as control, villages were chosen such that selected villages were physically isolated from the action villages. In some areas, which were internally homogeneous, it was possible to find control villages that were both similar to action villages and physically separate from them, whereas in others – with greater variations in topography, climate and access – this proved to be difficult. In the latter case, the M&E team decided to randomly select sites from an adjacent area.

The sampling of control households was done in three stages. In the first stage, and based on results from the site characterization, four control Sections were identified (Mtakataka Center and Thete in Dedza and Sitolo and Mwalaoyera in Ntcheu District). In the second and third stages, control villages and households were selected from the four control Sections using Probability Proportional to Size (PPS). In order to attain the target sample of 560 control households, 28 control villages and 20 households per village were sampled. The 10% reserve households sampled for Ntcheu were found to be inadequate and the reserve sample was raised to 25% for Dedza district.

1.2 MARBES Tools

To assess sustainable intensification trajectories, to provide evidence on the effectiveness of AR interventions, and to inform the development of scaling up and scaling out strategies, data need to be collected on the composition of households, crops grown at the plot level, livestock systems, farm and crop management practices, use of inputs, and key livelihood strategies employed. Towards this end, the M&E team developed detailed household and community questionnaires to capture baseline characteristics of AR beneficiary, non-beneficiary and control households and communities. These data are crucial to evaluate sustainable intensification trajectories, and evolution of changes in farm practices within the development domains of interest.

1.2.1 Household survey tool

The main objective of the household survey tool is to collect high-quality baseline household data to support the M&E activities of the AR Program in Malawi. More specifically, the survey collects detailed information on the composition of the household, employment, health, agriculture, income and expenditures, credit, assets, subjective welfare and food security, shocks, and the anthropometric status of children and women. Overall, the household survey questionnaire covers 22 modules (module A to V, Appendix Table A3 summarizes the modules).

A great emphasis is given to agricultural production and livestock rearing through six modules (modules E through J) dealing with agricultural land, crop inputs, crop production, crop sales and storage, livestock ownership and feeding. Information are gathered on the parcels of land used by the household, whether owned by the household or not. A specific feature of the survey tool regards the comparison of self-reported area of cultivated parcel with objective measurement through GPS of the same parcel of land on a sub-sample of farming households randomly selected. Module G looks in depth into the production of crops at the plot/parcel level. Hence, it asks information about different crops that were grown on each plot as well as the different varieties of the crops. In case of intercropping (i.e. multiple crops on the same plot), a 'bean game' has been included in the survey instrument to illustrate the distribution of crops on the same plot.

In order to capture the outcome variable of interest which can be used as key variables to assessing impact of AR program in Malawi we collect household income and consumption data through module Q to S. Subjective welfare and food security variables are collected at the household level in module P. Key challenges in agricultural production and their coping strategies are captured in module K. In order to evaluate the effect of increased agricultural production on nutritional status of the most vulnerable individuals within the household, namely women and children, module U and V are devoted to women and child anthropometry, respectively. Module U collects anthropometric measurements of women who are of reproductive age (i.e. 15 to 49 years) and who are not pregnant or breastfeeding whereas module V records body measurement of children between 0 to 59 months.

1.2.2 Community survey tool

The main objective of administering the community questionnaire is to collect baseline community data in 54 villages in the two districts (Dedza and Ntcheu) in Malawi. The community-level data complement the data from the household survey to analyze economic environment and market- and community-level challenges in agricultural production. Appendix Table A4 summarizes 9 modules (module CA to CI) included in the community survey tool. Community data are collected through focus groups with local leaders and knowledgeable community members. By engaging community leaders through focus group discussions, data are collected on access to basic services (module CC), agricultural labor, extension services and agricultural problems (module CD), land use (module CE), demographics (module CF), and water access, shocks, and food consumption (module CG).In additions, market prices of major food items and metric conversion data (module CH and module CI) are collected through visits to local markets and vendors.

1.3 MARBES implementation

A local survey firm called Invest in Knowledge Initiative (IKI) was contracted to collect the household and community survey data. The implementation of the survey took place between August and October 2013. A sampling frame was constructed to list the households living in the 54 target villages. This was done with the support from EPA officers. A total of 22 survey enumerators, 4 field supervisors and 2 quality control staffs were trained for three weeks. The enumerators' performance was assessed based on continuous performance during the training period and the quality of data collected in each pilot exercises. Ultimately, 16 enumerators were retained to continue with the survey implementation. During the training, all sections of the survey questionnaire were discussed question by question to have a common understanding of all the questions. Flip charts were used to demonstrate important details and calculations. Mock interviews and piloting of the survey instruments were done under the supervision of the trainers for demonstrating how best to collect the data.

Given the complexity of the survey instruments, the methodology identified for collecting the data is Computer Assisted Personal Interviewing (CAPI). The CAPI programming was implemented through Survey CTO which is based on Open Data Kit (ODK)[2]. The survey CTO program of the instruments was installed on tablets. A pilot phase of the instrument with Survey CTO was carried out during the training of the enumerators to incorporate any feedbacks from the field. Although the survey CTO platform was piloted successfully during the pilot activities, the platform was further improved during the first 5 days of field work. The translation of the questionnaire in Chichewa and back-translation in English were also finalized during the training period.

In the middle of August 2013 the team left for the field. Initial five days were spent on verification of the households which was carried out by the enumerators. The team was distributed in four sub teams for data collection. Each team included a supervisor, 4 enumerators and a driver. There was also a quality control team constituting 2 enumerators and one driver. A shorter version of the main questionnaire was developed for quality control. About 10-15% of the households in a village were re-interviewed by the quality control team. Any inconsistencies and missing data were collected with the recommendation from the quality control team.

[2] For further information, please see http://www.surveycto.com/index.html

2. Summary of MARBES results

2.1 MARBES-Households

2.1.1 Distribution of interviewed households

In two selected districts in Malawi, MARBES collected information on 1,149 households and 5,535 individuals. MARBES interviewed 404 households who benefitted from AR program (AR beneficiary), 201 households living in AR communities but not benefitting from the program (non-beneficiary), and 544 households in control communities (Control). Table 2.1.1 shows the distribution of households by geographical unites and research groups. The geographical disaggregation of interviewed households at the district level shows that there are 578 households in Dedza and 571 households in Ntcheu who successfully participated to the survey. In 28 control villages MARBES interviewed a total of 544 households (See Table A5 in the appendix for the detailed number of households interviewed in each control villages). Overall, 161 households were interviewed in eight control villages in Mtakataka Center Section, 78 household in four control villages in Sitolo Section, 164 households in nine control villages in Mwalaoyera Section, and 141 households in seven control villages in Thete Section. In 26 intervention villages, MARBES collected information for 605 households (See Table 6A in the appendix for detailed number of households interviewed in each intervention villages). 124 households were interviewed in four intervention villages in Golomoti Centre Section, 152 households were interviewed in five intervention villages in Mposa Section, 195 households were interviewed in eight intervention villages in Kampanje Section, and 134 household were interviewed in nine intervention villages in Mpamadzi Section.

Table 2.1.1: Distribution of households by area and research groups

				Number of households by treatment groups			
District	EPA	Section	Number of villages	AR Beneficiary	Non-beneficiary	Control	All
Dedza	Golomoti	Golomoti Centre	4	100	24		124
Dedza	Linthipe	Mposa	5	71	81		152
Ntcheu	Kandeu	Kampanje	8	139	56		195
Ntcheu	Nsipe	Mpamadzi	9	94	40		134
Ntcheu	Nsipe	Mwalaoyera	9			164	164
Dedza	Lobi	Thete	7			141	141
Dedza	Mtakataka	Mtakataka Center	8			161	161
Ntcheu	Kandeu	Sitolo	4			78	78
		Total	54	404	201	544	1,149

EPA level distribution of the households shows that Nsipe and Kandeu have the highest number (298 and 273 respectively) of interviewed households whereas Golomoti has the lowest number (124) of interviewed households. EPA level geographic distribution of interviewed households are depicted in Figure 2.1.1.

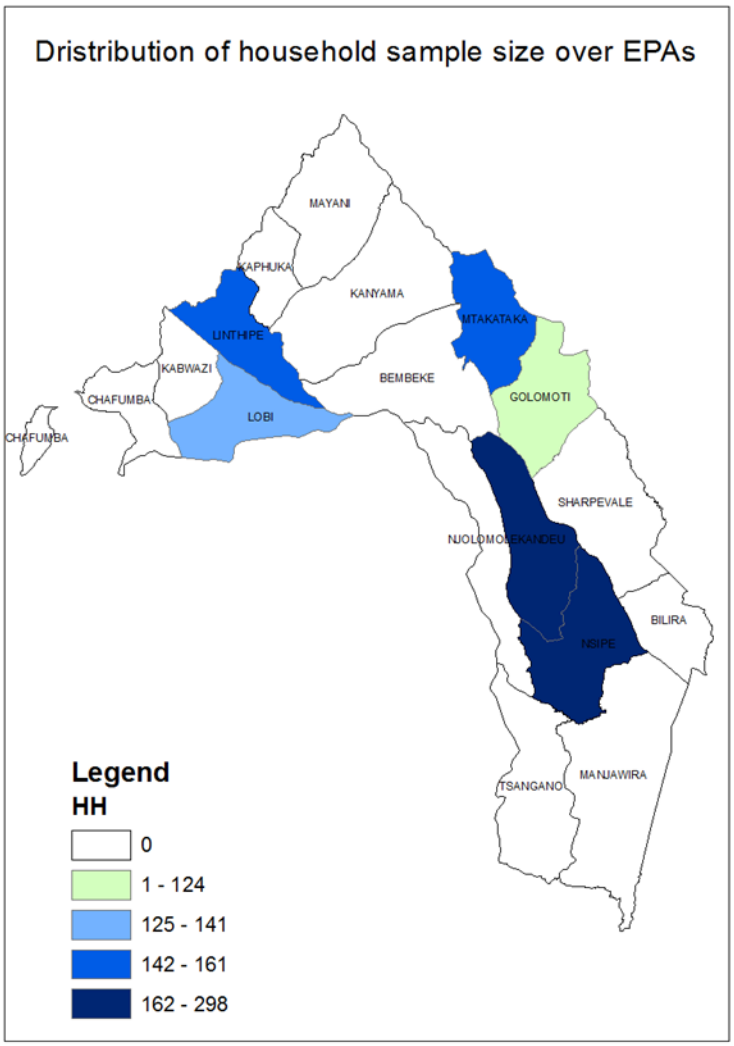

Figure 2.1.1: Distribution of sample size over EPAs

2.1.2 Demography

Table 2.1.2 reports household-level summary statistics of average household size, average adult years of education, average adult years of age, average age of household head, and dependency ratio. Dependency ratio is calculated as a ratio between the number of people aged below 15 years and above 64 years and the working population aged between 15 and 64 years. The average household size is 4.71 members and ranges between 1 to 12 members. Average adult years of age and education are 36.98 and 4.87, respectively. The average age of household head is 45.58 years and varies between 16 to 98 years. The average values of dependency ratio of the sample is 1.19 within a range from 0 to 7.

Table 2.1.2: Household level summary statistics by research groups

	Obs	Mean	St. Dev.	Max	Min
Household size	1,147	4.71	1.98	12	1
AR Beneficiary	405	4.97	1.93	12	1
Non-beneficiary	200	4.55	1.89	11	1
Control	542	4.57	2.02	11	1
Avg adult years of education	1,147	4.87	2.75	14	0
AR Beneficiary	405	5.22	2.61	12.5	0
Non-beneficiary	200	4.53	2.77	14	0
Control	542	4.73	2.83	12	0
Avg adult yrs of age	1,147	36.98	13.32	93	18
AR Beneficiary	405	36.87	11.9	77.5	18
Non-beneficiary	200	37.24	13.54	88	18.5
Control	542	36.97	14.23	93	18
HH head age in years	1,147	45.58	15.79	98	16
AR Beneficiary	405	45.73	14.16	86	18
Non-beneficiary	200	46.02	15.96	88	21
Control	542	45.32	16.86	98	16
Dependency ratio	1,147	1.19	0.92	7	0
AR Beneficiary	405	1.15	0.84	5	0
Non-beneficiary	200	1.23	1.01	7	0
Control	542	1.2	0.93	6	0

Table 2.1.3 reports the summary of the means and significance tests of equality of means among three research groups. Compared to non-beneficiary and control households, AR beneficiary households exhibit larger household size, higher average adult years of education, more likely to be married or cohabiting, and higher likelihood to be male headed household. From the t-test we see that average AR beneficiary household size is significantly different from that of non-beneficiary and control households, whereas average household size is not statistically different between non-beneficiary and control households. Similarly, the average adult years of education in AR beneficiary households is higher and statistically different from those of non-beneficiary and control households. Overall, about 66% of heads of household are either married (monogamous and polygamous) or living together with the distribution of married or cohabiting heads in AR beneficiary households are significantly higher (75%) than non-beneficiary (60%) and control households (65%).

Table 2.1.3: Significance of household level summary statistics by groups

	AR Beneficiary (1)	Non-beneficiary (2)	Control (3)	1 vs 2	1 vs 3	2 vs 3
Household size	4.97	4.55	4.57	**	***	
Avg adult yrs of education	5.22	4.53	4.73	***	***	
Avg adult yrs of age	36.87	37.24	36.97			
HH head age in years	45.73	46.02	45.32			
Dependency ratio	1.15	1.23	1.2			
% of HH head married or cohabiting	75.06	60.5	65.13	***	***	
% of HH head female	26.91	35.5	33.95	**	**	

Note: *Significance at 10%, **Significance at 5%, ***Significance at 1%

The household size and average adult years of education are further depicted by district and research group in Figure 2.1.2 and 2.1.3 respectively. The average household size of AR beneficiary in Ntcheu district is higher than that of Dedza district. Regarding average adult years of education, Ntcheu district has significantly higher number of years for all three research groups than Dedza district.

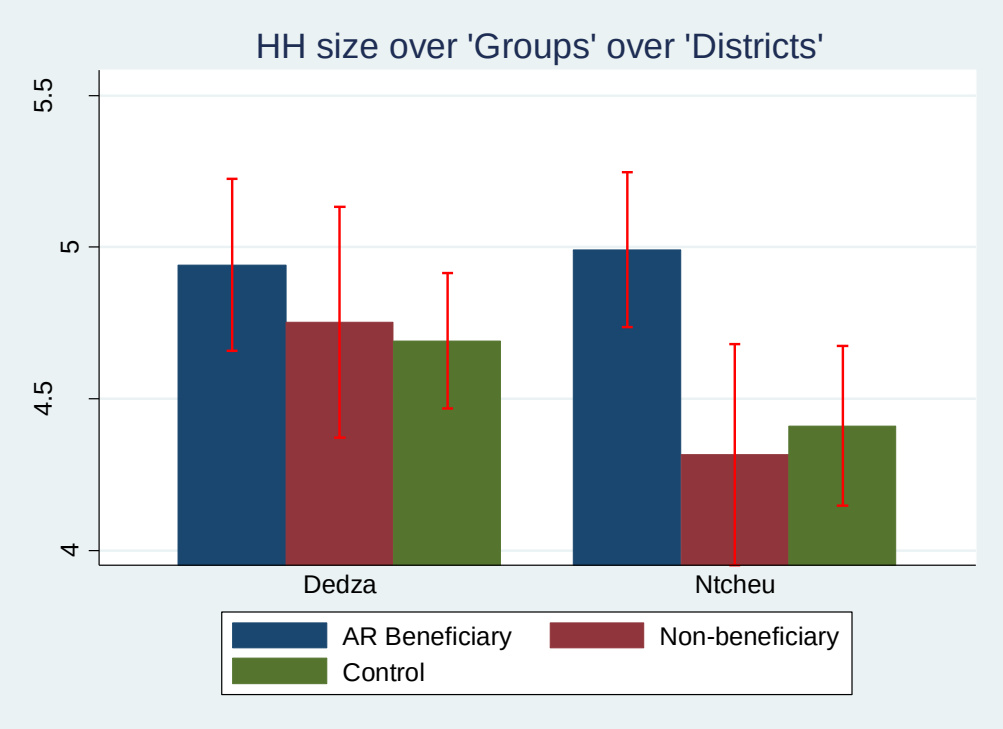

Figure 2.1.2: Average household size, by district and research group

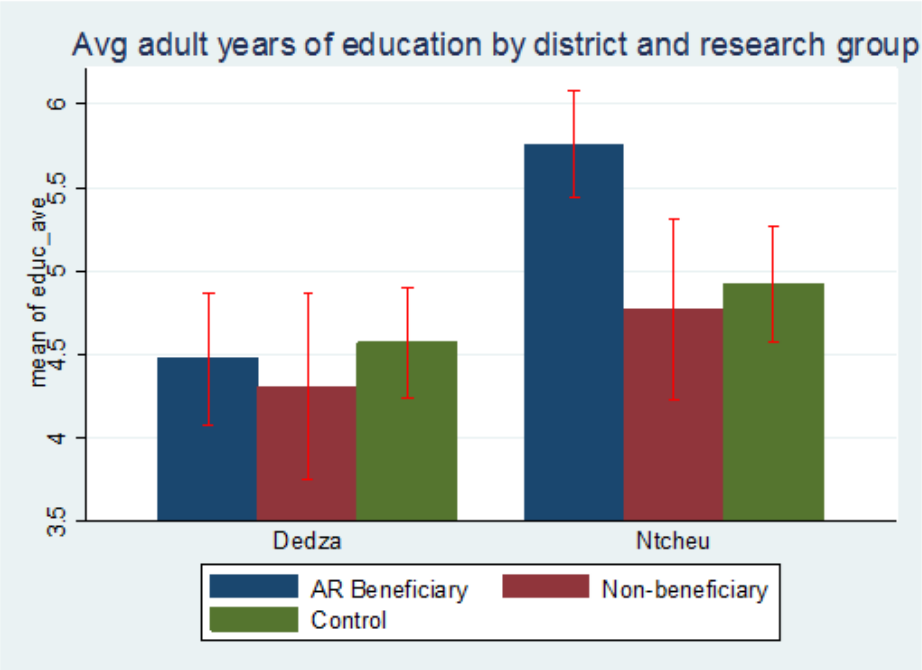

Figure 2.1.3: Average adult years of education by district and research groups

Table 2.1.4: Summary statistics of household head by research groups

	AR Beneficiary (%)	Non-beneficiary (%)	Control (%)	Total (%)
Religion				
Christian	96.79	85.57	94.11	93.56
Muslim	0.99	8.96	2.39	3.05
Other	2.22	5.47	3.5	3.39
Gender				
Male	73.15	64	66.05	68.21
Education				
No School	10.86	18.04	19.21	16.06
Std 1-4	33.85	37.11	34.28	34.61
Std 5-8	40.15	31.44	31.08	34.35
Form1-3	11.62	6.18	9.97	9.9
O level and above	3.53	7.22	5.46	5.09
Primary economic activity				
Crop production	89.39	84.02	81.54	84.75
Non-farm employee	4.29	8.25	6.78	6.16
Farm employee	1.01	1.03	0.94	0.98
Self employed	4.55	3.61	7.72	5.89
Others	0.75	3.1	3.02	2.23

Table 2.1.4 shows the summary statistics of key variables of household head by research group. Christian is predominantly the main religion declared by 93% of heads of the household, followed by 3% household heads declaring to be Muslim. About 68% of the households are male-headed with the distribution of male-headed households being higher (73%) among AR beneficiary households than that of non-beneficiary (64%) and control (66%) households. The average age of the head of the household is about 46 years across all research sample groups. Regarding education level of the household head, about 16% of head of household reported no schooling whereas a modest 5% reported o level or above (more than 12 years of education). About 34% of head of household received education between standard 1 to standard 4. Other 34% have achieved education level between grad 5 to grade 8. A modest 10% received education level between Form 1 to Form 3. In relation to primary economic activity, about 85% of head of household are involved in crop production whereas 6% of heads identified non-firm employment as their primary economic activity and about 6% declared to be self-employed.

2.1.3 Agricultural land

Table 2.1.5 presents the summary statistics of household level agricultural land by three research groups. MARBES collected information on 2726 parcels of land distributed over 1149 households. The average land size at the household level is 2.73 hectares with the distribution varies widely across the three research groups. The average household land size for AR beneficiary households is significantly higher (3.84 hectares) than that of non-beneficiary (2.44) and control (2.01) households (see table 2.1.6 for t-test of comparing means among the three research groups). The overall average per capita land size at household level is 0.26 hectares but this value is significantly higher (0.3 hectares) in AR beneficiary households than non-beneficiary (0.24 hectares) and control (0.23 hectares) households. Further, the average number of parcels by household in the sample is 2.36, with significant variation among the research groups. Among AR beneficiary households the average number of parcels is 2.89, among non-beneficiary households it is 2.36, and among control households it is 1.96. In terms of irrigation, less than 1% household reported irrigating their land in rainy season whereas about 10% households declared irrigating their land in dry season. From t-test we see that percentage of AR household using irrigation in dry season is significantly higher (15%) than that of control (6%) households. With respect to one way travel time to the nearest parcel with usual mode of transport, about 62% households have closest parcel within 15 minutes away, about 21% households have them between 15 to 30 minutes away, 13% households have them between 30 to 60 minutes away, and 5% households have them more than 60 minutes away.

Table 2.1.5: Summary statistics of agricultural land by research group

	Obs	Mean	St. Dev.	Max	Min
Avg hh land size (ha)	1,149	2.73	2.93	33.39	0
AR Beneficiary	405	3.84	3.43	33.39	0.1
Non-beneficiary	201	2.44	2.15	11.33	0
Control	543	2.01	2.5	21.04	0
Per capita land size(ha)	1,147	0.26	0.3	5.83	0
AR Beneficiary	405	0.3	0.38	5.83	0.03
Non-beneficiary	200	0.24	0.19	1.08	0
Control	542	0.23	0.25	2.14	0
No. of parcels by hh	1,149	2.36	1.19	10	1
AR Beneficiary	405	2.89	1.24	10	1
Non-beneficiary	201	2.36	1.05	5	1
Control	543	1.96	1.05	8	1

Table 2.1.6: Summary and significance of agricultural land variables by research group

	AR Beneficiary (1)	Non-beneficiary (2)	Control (3)	Total	1 vs 2	1 vs 3	2 vs 3
Avg hh land size (ha)	3.84	2.44	2.01	2.73	***	***	**
Per capita land size(ha)	0.3	0.24	0.23	0.26	**	***	
No. of parcels by hh	2.89	2.36	1.96	2.36	***	***	***
% of hhs using irrigation in rainy season	0.99	0.5	0.74	0.78			
% of hhs using irrigation in dry season	15.31	10.95	6.08	10.18		***	**
% of HH with closest parcel <15 minutes	74.32	57.29	53.53	61.56	***	***	
% of HH with closest parcel 15-30 minutes	14.57	25.13	24.16	20.93	**	***	
% of HH with closest parcel 30-60 minutes	8.15	14.57	15.24	12.61	**	***	
% of HH with closest parcel >60 minutes	2.96	3.02	7.06	4.9		***	**

Note: *Significance at 10%, **Significance at 5%, ***Significance at 1%

The summary of agricultural land variables are further depicted by district and research group in Figure 2.1.4 to Figure 2.1.7. Figure 2.1.4 shows that on average Ntcheu district has higher average household land size than Dedza district for all three research groups. The average number of parcels for AR beneficiary and non-beneficiary households are higher in Ntcheu compared to Dedza whereas that figure is lower for control households in Ntcheu compared to

Dedza (Figure 2.1.5). With respect to irrigation, the percentages of households using irrigation in dry season are significantly higher in Ntcheu compared to those of Dedza for all three research groups (Figure 2.1.6). Figure 2.1.7 shows that the percentages of households with closest parcel within 15 minutes away (in terms of one way travel time) in Ntcheu are significantly higher than those of Dedza for all three research groups.

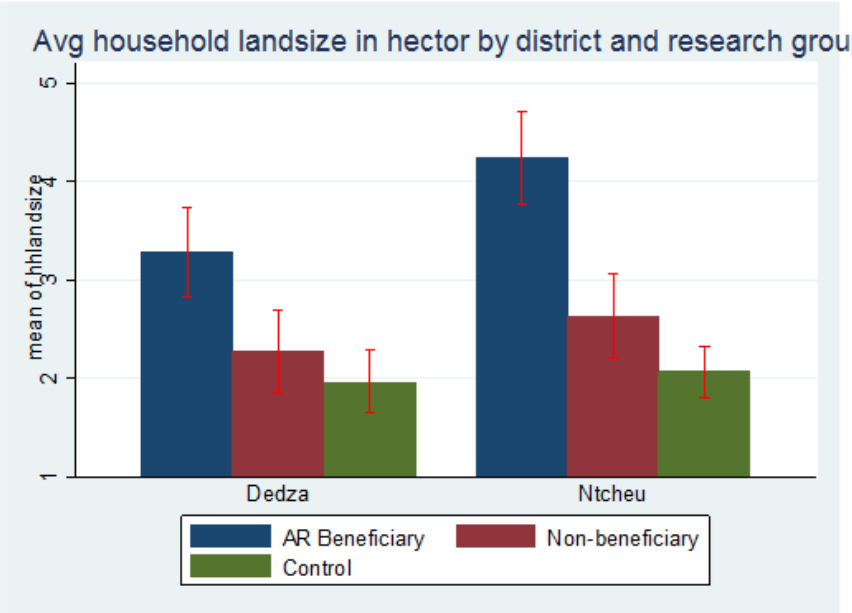

Figure 2.1.4: Avg hh land size (ha) by district and research group

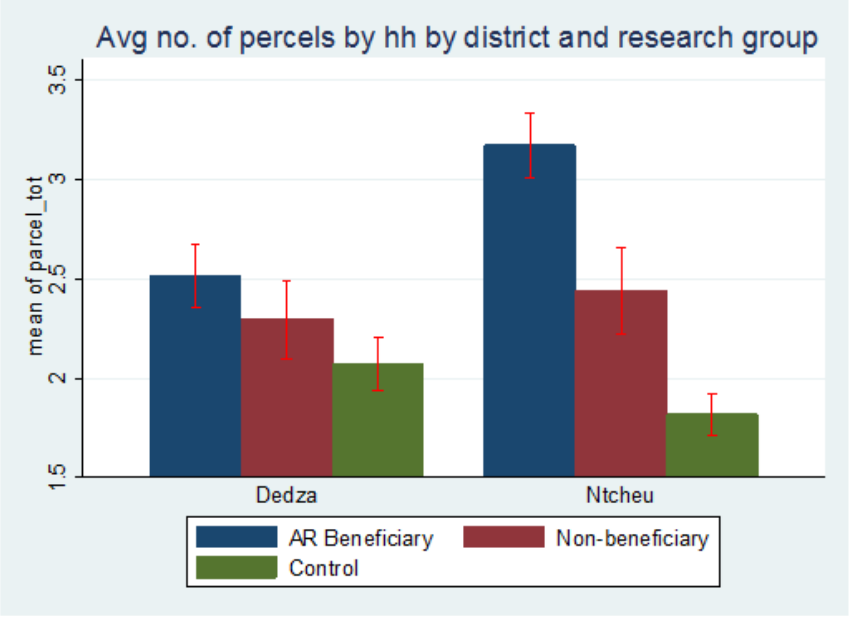

Figure 2.1.5: Avg no. of parcels by hh by district and research group

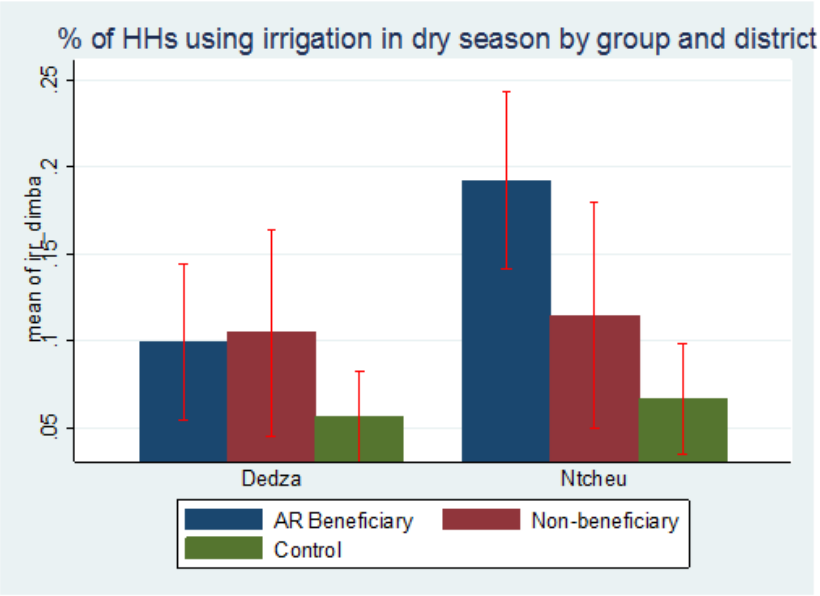

Figure 2.1.6: Percentage (%) of hh using irrigation in dry season by district and research group

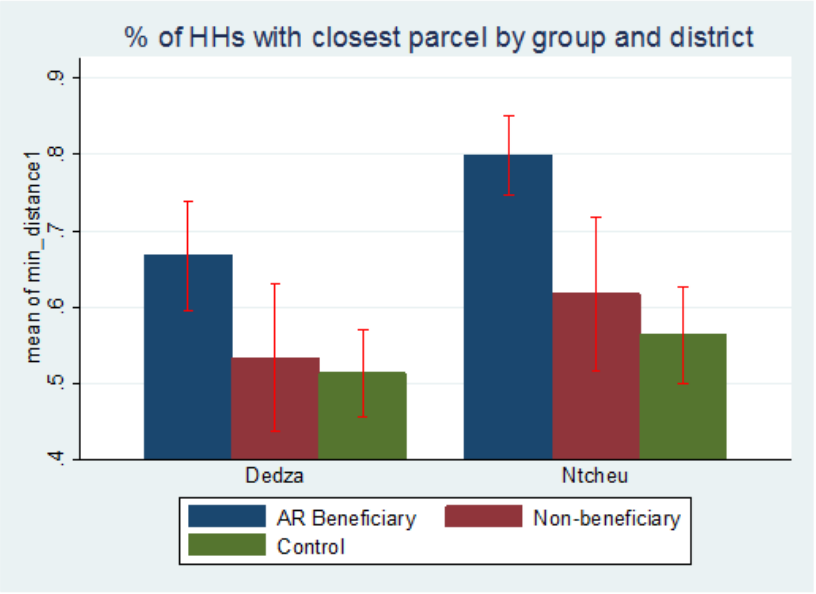

Figure 2.1.7: Percentage (%) of hh with closest parcel within 15 minutes away by district and research group

2.1.4 Agricultural production and inputs

MARBES collected information on crops grown by the households, area under cultivation, production, and input usage and practices. Table 2.1.7 reports the percentage of households cultivated key crops by research groups. It is seen that almost entire sample (99.7%) cultivate maize. Groundnut is the second major crop cultivated with overall 70% households being involved in its cultivation but there is great variation of percentage of households among three research groups. Among AR beneficiary households the percentage of groundnut cultivating households is 84%, among non-beneficiary households is 70% and 60% among the control

households. Soybean and beans are the third and fourth major crops cultivated by 49% and 44% households, respectively. Looking at the distribution of households growing soybean, it particularly dominant crop for AR beneficiary households (72%) compared to non-beneficiary (51%) and control households (31%). In contrast, beans is dominant crop among non-beneficiary households, as 56% declared growing such crop. Cowpea, millet and pigeon pea are also important crops cultivated in the sample by 24%, 19% and 13%, respectively. Other crops cultivated are sweet potato, sorghum, Bambara, rice and chickpea but they attract relatively small percentage of households.

Table 2.1.7: Percentage of households who cultivate various crops

	AR beneficiary	Non-beneficiary	Control	Total
Maize	99.5	100.0	99.8	99.7
Groundnut	83.9	69.4	59.1	69.7
Soyabean	71.8	51.3	30.7	48.8
Beans	37.6	56.3	44.2	44.0
Cowpea	37.1	26.1	12.5	23.6
Millet	24.0	20.1	14.5	18.8
Pigeonpea	28.5	7.5	2.4	12.5
Sweetpotato	9.7	11.1	5.2	7.8
Sorghum	8.9	9.6	5.6	7.5
Bambara	2.5	3.0	2.8	2.7
Rice	2.2	0.5	0.9	1.3
Chickpea	1.2	0.5	0.2	0.6

Table 2.1.8 shows average cultivated land area devoted to the abovementioned crops by research groups. The average cultivated area is 0.95 hectares per household. From the distribution of cultivated land area by crops, each household on average cultivates 0.46 hectares with maize, 0.12 hectares with groundnut, 0.08 hectares with beans, and 0.07 hectares with soybean. Cowpeas, millet, pigeon pea and sweet potato are grown in 0.03, 0.03, 0.01, and 0.01 hectares on average by a household, whereas other crops attract negligible size of area on average by a households. Intercropping is widely used practice in the sample, overall 79% households practice intercropping. On average less percentage of control households practice intercropping compared to AR beneficiary and non-beneficiary households. On average, 1.87 number of crops are cultivated in each plot whereas average number of plots per households is 3.55. Average number of intercropped plots per households is 1.5, whereas average size of intercropped plot is 0.54 hectares for each household. In terms of legume intercropping, about 0.23 hectares are allocated on average per household.

Table 2.1.8: Average cultivated area (in hectares) by groups and intercropping

	AR Beneficiary	Non-beneficiary	Control	Total
Avg cultivated area by hh	1.18	0.89	0.80	0.95
Maize	0.53	0.43	0.42	0.46
Groundnut	0.13	0.11	0.12	0.12
Beans	0.06	0.09	0.10	0.08
Soyabean	0.10	0.08	0.06	0.07
Cowpeas	0.05	0.03	0.01	0.03
Millet	0.04	0.03	0.02	0.03
Pigeonpea	0.03	0.01	0.00	0.01
Sweetpotato	0.01	0.01	0.01	0.01
Sorghum	0.01	0.01	0.00	0.00
Bambara	0.00	0.00	0.00	0.00
Rice	0.00	0.00	0.00	0.00
Chickpea	0.00	0.00	0.00	0.00
Intercropping				
Avg no of plots at hh	4.89	3.35	2.61	3.55
Avg no of crop per plot	1.89	2.03	1.78	1.87
Avg no of intercropped plots at hh	1.88	1.66	1.15	1.50
Avg intercropped area at household (ha)	0.63	0.57	0.46	0.54
Avg legume-intercropped area at hh (ha)	0.27	0.25	0.19	0.23
% of hh practicing intercropping	84.65	88.44	70.26	78.53

Table 2.1.9 reports the average production of main crops in kilograms from a hectare of land. The output of each crop was reported in local measurement units. We converted the local units of quantity to kilograms by direct transformation of local units given in questionnaire and by using community level crop-location specific conversion. The yield data are plotted in a histogram in Figure 2.1.8 that shows that on average sweet potato provides the highest yield with an average yield of 2909 kg/ha, followed by rice with an average yield of 2497 kg/ha. The average yield of maize, the most important crop in the sample, is reported to be 1826 kg/ha and the average yield for AR beneficiary (2027 kg/ha) and non-beneficiary (2137.6 kg/ha) households are much higher than that of control households (1560 kg/ha). The average yield of groundnut, millet and soybeans are 1184 kg/ha, 785 kg/ha and 679 kg/ha, respectively. Although widely grown crops the yield of beans, pigeon pea, chick pea and bambara are reported to be the lowest on average in the sample, the yields being 503 kg/ha, 343 kg/ha, 365 kg/ha, 421 kg/ha, respectively.

Table 2.1.9: Average yield in kg per hectare of main crops by research groups

	AR Beneficiary	Non-beneficiary	Control	Total
Maize	2027.4	2137.6	1560.7	1826.4
Millet	908.3	580.5	738.4	785.7
Rice	3302.9	1482.6	1251.5	2497.8
Beans	522.1	488.3	498.0	503.1
Soyabean	661.2	652.4	727.5	679.2
Pigeonpea	338.3	325.3	411.4	343.6
Chickpea	297.3	882.5	192.2	365.9
Cowpeas	310.0	414.3	615.7	406.3
Groundnut	1266.1	1336.0	1031.2	1184.2
Bambara	526.9	457.5	331.6	421.9
Sweetpotato	2709.4	2953.3	3067.0	2909.9

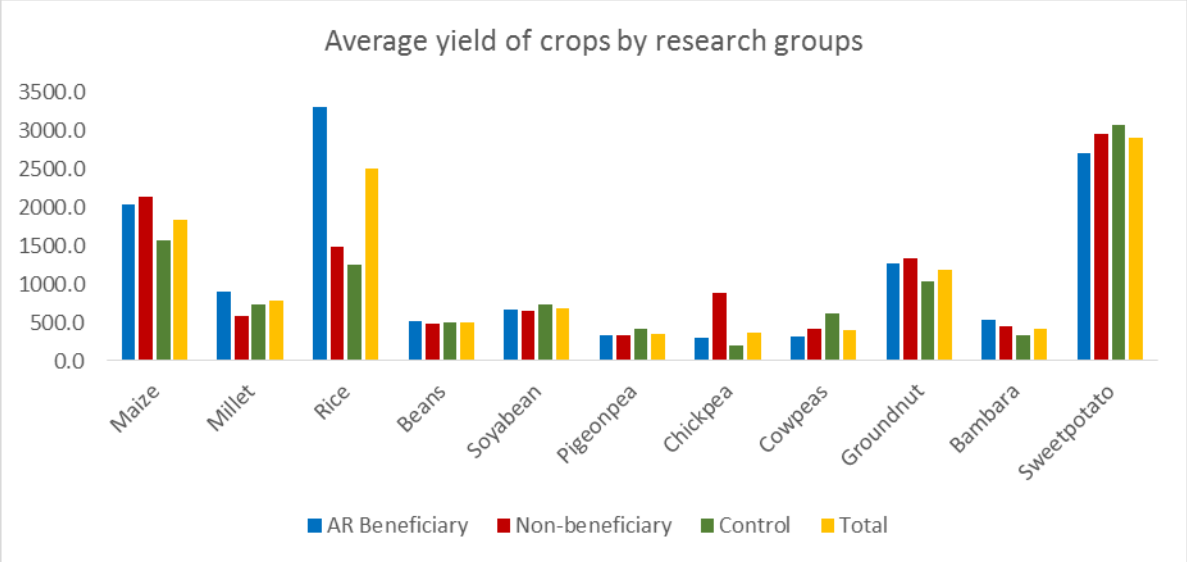

Figure 2.1.8: Avg. yield of selected crops in kg/ha

In terms of agricultural input use during rainy season, overall 23% households declared use of chemical fertilizer. The average amount of fertilizer application per household is 95 kg. On average the amount of fertilizer use per household for AR beneficiary households are higher than that of non-beneficiary and control households. In terms of labor inputs, on average 42% of households employ hired labor and 33% of households use communal labor in agricultural production. Regarding access to seed, the average time to nearest seed supplier is reported to be 41 minutes (one way with usual mode of transport). Crop rotation is a common practice in the sample, about 71% households practice crop rotation. The percentage of households practicing crop rotation in AR beneficiary (85%) households is higher than that of non-beneficiary (73%) and control households (59%). Practicing fallowing is observed only for 9% of the sample households. Zero tillage for soil moisture conservation is practices rarely in the sample, about 1% of the sample households. In terms of manure use almost half household in the sample apply manure. The percentage of households using manure for AR beneficiary (68%) and non-beneficiary (55%) households are higher than that of control households (43%). Overall,

the percentage of households using improved maize seed is 71%, improved maize seed is used by 87% of the AR beneficiary households whereas only 64% of non-beneficiary and 61% of control households.

Labor use data in person-days as agricultural input were also collected in the survey. The average total person-days including communal labor for the entire sample is 270. The gendered breakdown of the average person-days use in agriculture is the following. For male agricultural labor the total person-days used on average is 125, whereas for female agricultural labor, the average total person days is 139. The average values of the fertilizer purchased per household is reported to be 14380 MWK. I terms of the value of seed purchase, the average values per household for traditional see is 652 MWK, whereas the average value for improved seed is 1472 MWK per household.

Table 2.1.10: Households using agricultural inputs and practices

	AR Beneficiary	Non-beneficiary	Control	Total
% of hh using fertilizer	26.4	18.9	22.7	23.3
Avg amount of fertilizer used per hh in kg	121.2	83.3	80.5	95.4
% of hh using hired labor	50.6	31.3	38.9	41.7
% of hh using communal labor	36.8	28.9	31.3	32.8
Avg travel time to seed supplier (one way in minutes)	43.6	41.9	39.0	41.1
% of hh practicing rotation	84.7	73.1	59.3	70.7
% of hh practicing fallowing	9.4	6.5	9.8	9.1
% of hh using manure	67.9	55.2	42.7	53.8
% of hh practicing zero tillage	2.7	0.0	0.2	1.0
% of hh using improved maize seed	86.9	64.3	61.5	71.0
Person-days				
Total person-days used, male	167.8	106.6	99.2	124.7
Total person-days used, female	166.1	127.1	122.5	138.7
Total person-days, male & female	333.9	233.7	221.7	263.3
Total person-days, male & female (incl. communal labor)	342.3	240.3	227.9	270.4
Value of agricultural inputs in MWK				
Value of fertilizer purchased per hh	20006.8	12424.6	10908.3	14380.6
Value of traditional seeds purchased by hh	708.7	716.8	587.2	652.7
Value of improved seeds purchased per hh	1436.9	1200.9	1598.9	1472.2

The summary of fertilizer use, labor input, access to seed and improved maize seed use are further depicted by district and research group in Figure 2.1.9 to Figure 2.1.12. Figure 2.1.9 shows that on average Ntcheu district has higher average amount of fertilizer use per household than Dedza district for all three research groups. Similarly, as depicted by Figure 2.1.10, the average person-days used (including communal labor) in Ntchue is higher than that of Dedza for all three research groups. The average travel times (in minutes for one way travel with usual model of transport) to see supplier are much higher in Ntcheu compared to Dedza for the research groups, meaning on average, access to seed is more difficult in Ntcheu than Dedza

(Figure 2.1.11). The percentage of households using improved maize seed are similar for both the districts except the percentage is significantly hgher for SR beneficiary households of Ntcheu compared to AR beneficiary households in Dedza (Figure 2.1.12).

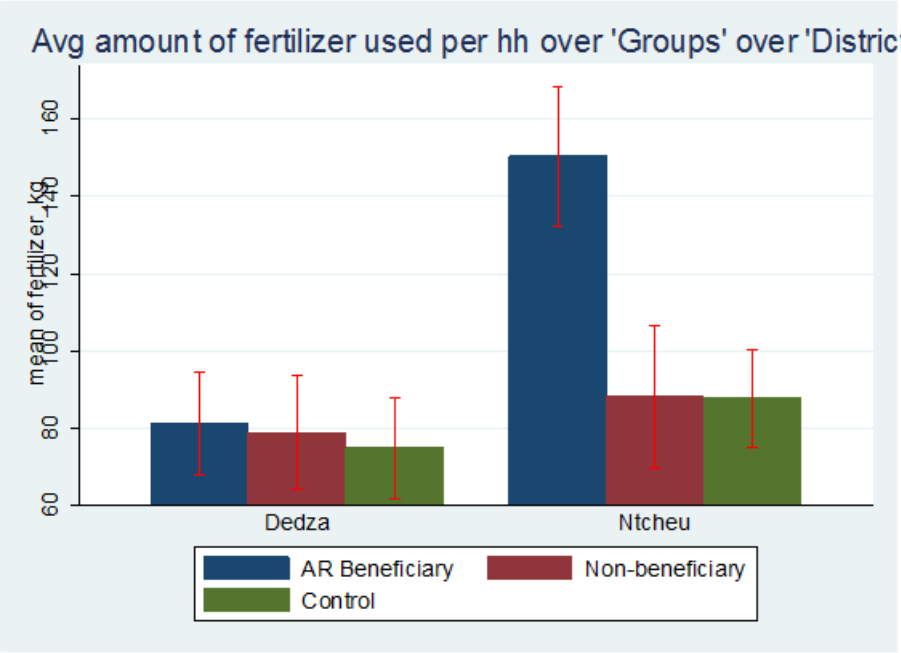

Figure 2.1.9: Average amount of fertilizer use by district and research group

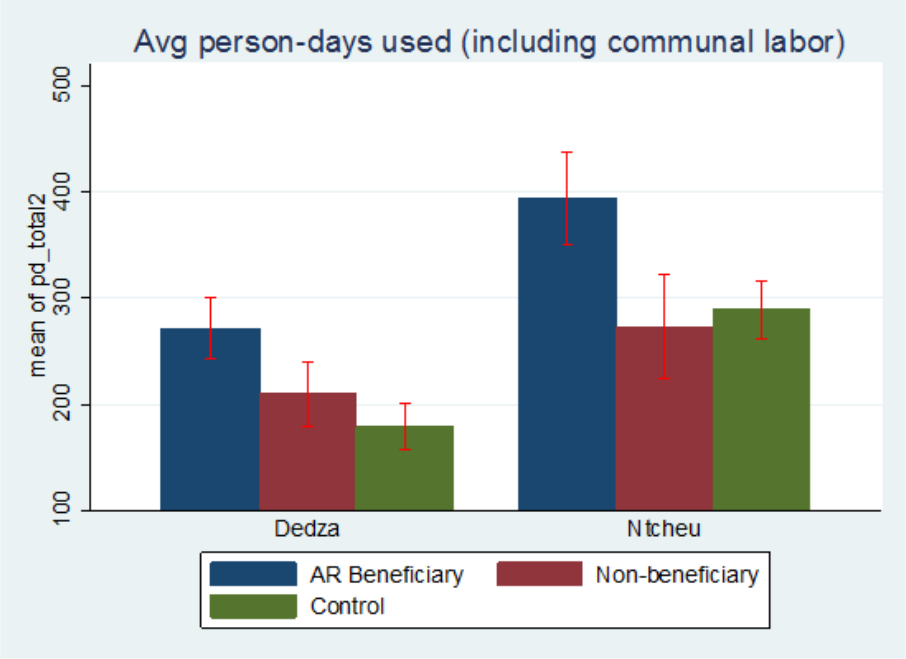

Figure 2.1.10: Average person-days used (including communal labor) by district and research group

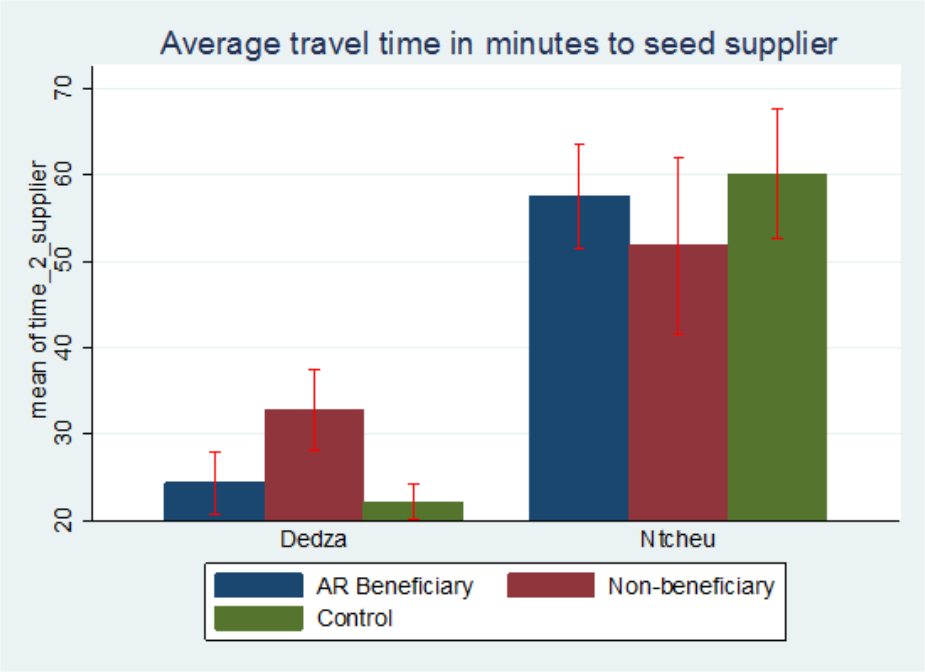

Figure 2.1.11: Average travel time in minutes by district and research group

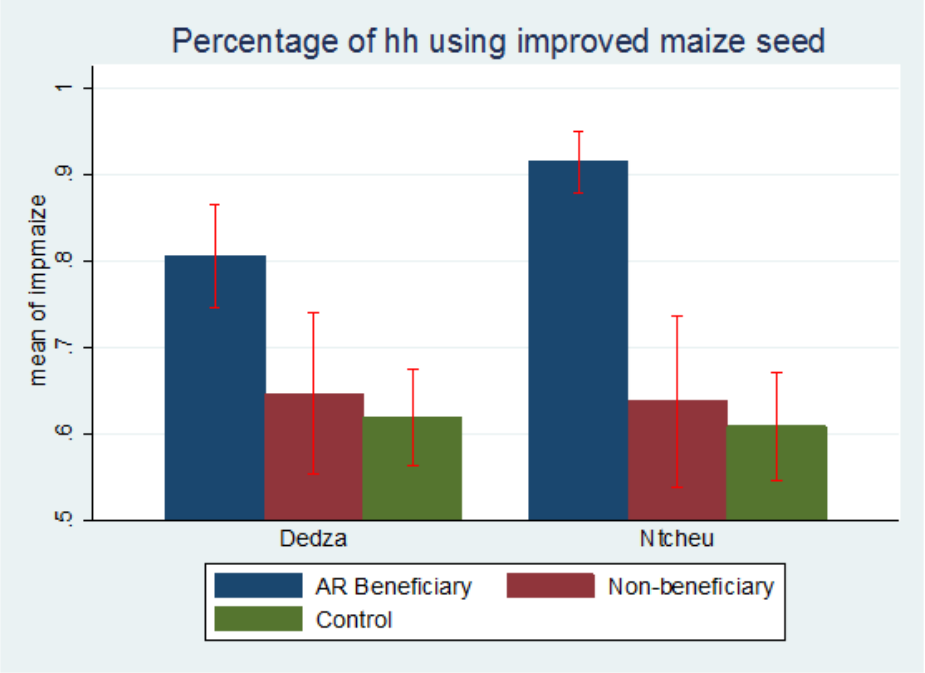

Figure 2.1.12: Percentage of households using improved maize seed by district and research group

2.1.5 Crop storage

MARBES collected information about crop storage condition in the household survey. Table 2.1.11 shows that 96% of households reported that they had maize in storage one month after harvest. For other key crops such as groundnut, finger millet, rice, bean and soybean the percentage of households that declared keeping the crops in storage one month after harvest are 91%, 89%, 88%, 88%, 87%, respectively.

Table 2.1.11: Percentage of households that had crop in storage one month after harvest

	AR beneficiary	Non-beneficiary	Control	Total
Maize	95.1	96.6	95.6	95.6
Groundnut	89.1	95.8	91.0	91.0
Soybean	85.9	89.1	87.4	86.9
Bean	84.4	84.6	91.8	87.9
Tobacco	25.0	12.5	38.1	27.1
Cow-peas	65.5	75.0	67.3	67.8
Cotton	25.0	0.0	0.0	21.4
Finger millet	93.3	82.5	87.1	89.0
Pearl millet	66.7	28.6	88.9	72.1
Sweet potato	69.1	65.2	71.9	69.1
Cassava	0.0	0.0	28.6	16.7
Rice	90.0	100.0	83.3	88.2
Bambara nuts	77.8	79.0	72.7	76.3

Table 2.1.12 presents storage facilities used by the households for the three main crops in the sample. From the table it can be seen that sacks/bags are the main storage facility employed by MARBES households. For maize, 65% of households used sacks/bags as storage facility, whereas 28% households stored in granary. For groundnut and soybean, 89% and 87% respective households reported use of sacks/bags as storage facility.

Table 2.1.12: Percentage of households using various storage facility

Crop	Storage facility	AR beneficiary	Non-beneficiary	Control	Total
Maize	Granary	33.6	37.6	20.2	28.1
	Warehouse or commercial storage	0.0	0.0	0.2	0.1
	Drums	0.0	0.0	0.0	0.0
	Cribs	0.0	0.0	0.0	0.0
	Sacks/bags	58.6	55.6	73.3	64.9
	Raised platform	0.2	0.0	0.2	0.2
	Open ground	0.0	0.0	0.0	0.0
	Multiple methods	1.2	1.0	0.7	0.9
	Other	1.4	2.4	1.1	1.4
Groundnut	Granary	0.0	0.7	0.3	0.2
	Warehouse or commercial storage	0.0	0.0	0.0	0.0
	Drums	0.3	0.0	0.3	0.2
	Cribs	0.0	0.0	0.0	0.0
	Sacks/bags	87.1	95.1	89.2	89.3
	Raised platform	0.0	0.0	0.0	0.0
	Open ground	0.0	0.0	0.0	0.0
	Multiple methods	0.0	0.0	0.0	0.0
	Other	1.7	0.0	1.2	1.2
Soybean	Granary	0.0	0.0	0.0	0.0
	Warehouse or commercial storage	0.0	0.0	0.0	0.2
	Drums	0.0	0.0	0.0	0.2
	Cribs	0.0	0.0	0.0	0.0
	Sacks/bags	90.0	100.0	83.3	85.2
	Raised platform	0.0	0.0	0.0	0.0
	Open ground	0.0	0.0	0.0	0.0
	Multiple methods	0.0	0.0	0.0	0.0
	Other	0.0	0.0	0.0	1.3

2.1.6 Livestock

Table 2.1.13 presents the average number of animals owned by a household. On average, a household owns 4.4 chickens, 1.4 goats, 0.8 other animals, 0.6 pigs and 0.2 cattle. Figure 2.1.13 depicts the average number of livestock ownership by the three research groups. On average, the number of livestock ownership is higher for AR beneficiary households than that of non-beneficiary and control households.

Table 2.1.13: Average no of animal owned by households

	AR Beneficiary	Non-beneficiary	Control	Total
Cattle	0.5	0.3	0.1	0.2
Equines	0.0	0.0	0.0	0.0
Goats	2.2	1.3	1.0	1.4
Pigs	0.8	0.5	0.4	0.6
Chicken	5.9	4.2	3.4	4.4
Beehive	0.0	0.0	0.0	0.0
Other animal	1.2	0.4	0.7	0.8

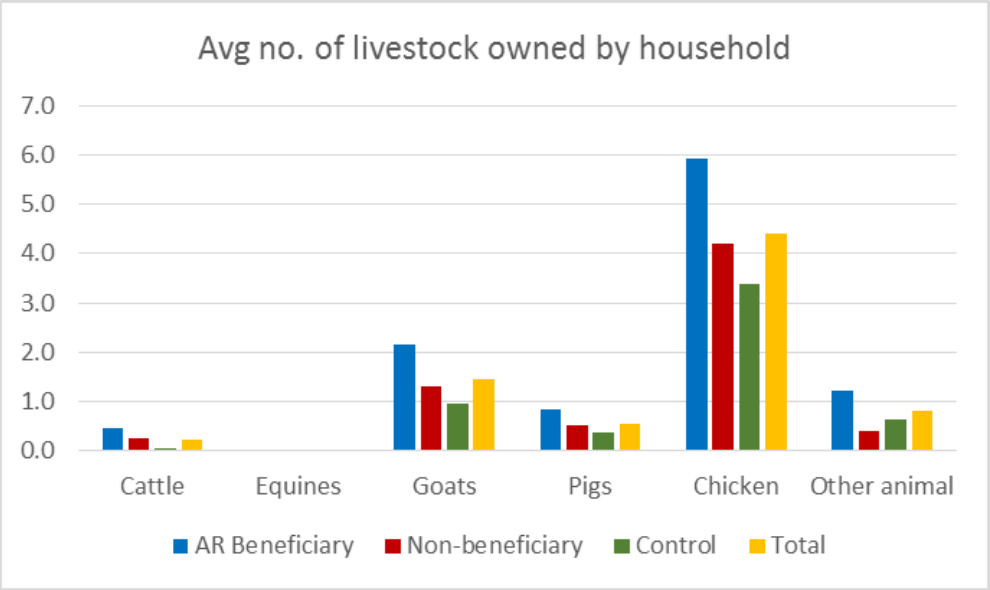

Figure 2.1.13: Average number of livestock owned by household by research group

2.1.7 Housing and wealth index

MARBES collected information on condition of the dwelling unit such as materials used for the wall, floor and roof, source of drinking water, type of toilet etc. Table 2.1.14 provides summary of the characteristics of housing for the three research groups and for the whole sample. From the table it is seen that on average 65% households use mud/ mud brick/clay as main material for wall of the housing unit, and a moderate 34% households use stone/ burned bricks for wall of the house.

Table 2.1.14: Characteristics of housing- percentage of households

	AR beneficiary	Non-beneficiary	Control	Total
Material for wall				
Mud/mud brick/clay	53.6	68.2	71.8	64.8
Wood/bamboo	0.3	0.0	0.4	0.3
Stone/burned bricks	44.9	29.9	26.7	33.7
Cement/sandcrete bloc	1.2	1.5	0.7	1.0
Thatch/cardboard	0.0	0.0	0.4	0.2
Other	0.0	0.5	0.0	0.1
Material for floor				
Earth/mud/mud brick	88.2	89.1	90.2	89.3
Stone	0.0	0.0	0.2	0.1
Cement/concrete	11.9	10.5	9.6	10.5
Other	0.0	0.5	0.0	0.1
Material for roof				
Leaves/raffia/thatch	67.2	76.6	75.5	72.8
Corrugated metal	30.1	19.9	21.4	24.2
Asbestos/slate/tiles	0.0	0.0	0.7	0.4
Mud/earth roof (tembe	0.0	0.0	0.2	0.1
A combination	2.5	2.5	2.2	2.4
Other	0.3	1.0	0.0	0.3
Source of drinking water				
Piped into dwelling	1.0	3.0	0.0	0.9
Public tap	19.5	14.9	3.3	11.1
Borehole, well & pump	75.1	73.6	90.6	82.2
Well without pump	2.2	6.5	3.5	3.6
Spring	1.0	0.0	0.2	0.4
Pond/Lake/Dam	0.0	0.0	0.2	0.1
River	1.2	1.5	2.2	1.7
Other	0.0	0.5	0.0	0.1
Type of toilet				
Private KVIP	0.0	0.5	0.2	0.2
Shared KVIP	1.0	3.5	0.4	1.1
Private latrine	82.7	66.7	65.8	71.9
Shared latrine	16.1	28.9	32.8	26.2
Bush or field	0.3	0.0	0.9	0.5
Other	0.0	0.5	0.0	0.1

Regarding materials for floor, 89% households report use of earth/mud/mud brick and 11% households use cement/concrete as main material for floor of the house. In terms of material used for roof, 73% households report use of leaves/raffia/ thatch as the main material for roof, a moderate 24% households employ corrugated metal for constructing roof of the housing unit. MARBES also collected sources of drinking water and type of toilet to assess household health information. Majority of the households (82%) report to access drinking water from borehole, well and pump, whereas 11% households have access to public tap for drinking water. Only 4% households report to have well without pump for drinking water and 2% household source drinking water from river. In terms of type of toilet, majority of households (72%) have private latrine, a moderate 26% households have access to shared latrine. For other remaining households, 1% households have access to shared KVIP (Kumasi Ventilated Improved Pit) and 0.5% use bush or field as a type of toilet.

We construct aggregate wealth index using housing condition, durable non-agricultural assets, durable agricultural assets, livestock ownership and land ownership. We compute aggregate wealth index through factorial analysis using principle component factor (PCF) method. Table 2.1.15 shows the summary statistics of the household level aggregate wealth index in quintiles. The higher the wealth index for a household, the wealthier are its members on average.

Table 2.1.15: Aggregate wealth index

Wealth index	No. of households	Mean	Std. Dev.	Max	Min
First quintile (poorest 20%)	230	-0.78	0.09	-0.64	-1.01
Second	230	-0.52	0.08	-0.39	-0.64
Third	230	-0.25	0.08	-0.11	-0.39
Fourth	230	0.11	0.15	0.41	-0.11
Fifth (richest 20%)	229	1.44	1.4	12.44	0.41
Total	1,149	0	1	12.44	-1.01

2.1.8 Interaction with Africa RISING

Table 2.1.16 summarizes the knowledge and participation in Africa RISING (AR) activities. Only 38% of households reported to have heard about Africa RISING program. As expected more percentage (93%) of AR beneficiary households heard about AR than that of non-beneficiary (24%) and control households (2%). 33% households from the whole sample reported to have participated in any AR activity as part of AR program. Regarding involvement with AR related activities, community meetings is the first activity reported by 22% households, followed by trainings and demonstration field days reported by 7% and 3% of households, respectively. Among the second activity, trainings and demonstration field days are reported as main activities identified by 15% and 7% of the households, respectively. Among the third activity, demonstration field days remain the main AR activity reported by 12% households.

Table 2.1.16: Knowledge and participation in AR activities

	AR Beneficiary	Non-beneficiary	Control	Total
% of hhs who heard about AR	92.6	23.5	1.5	37.6
% of hhs who participated in AR	90.4	8.5	0.2	33.4
% of hhs first AR activity				
Community meetings	59.3	4.5	0.0	21.7
Trainings	18.8	1.0	0.0	6.8
On-farm experimentation	4.7	0.5	0.0	1.7
Demonstration field days	6.4	2.5	0.0	2.7
Other	1.2	0.0	0.2	0.5
% of hhs second AR activity				
Trainings	42.2	3.0	0.0	15.4
On-farm experimentation	15.6	0.5	0.0	5.6
Demonstration field days	19.0	1.5	0.0	7.0
Other	0.7	0.0	0.0	0.3
% of hhs third AR activity				
On-farm experimentation	9.9	0.5	0.0	3.6
Demonstration field days	33.8	2.0	0.0	12.3
Other	1.2	0.0	0.0	0.4

2.1.9 Agriculture related shocks

MARBES collected information on recent shocks to household welfare over the past five years (Table 2.1.17). On average, 48% of households reported to have suffered from agriculture related shocks in past five years. In particular, 45% households reported to have severely affected negatively from drought or flood over the past five years. Large rise in agricultural input prices and price of food are identified to have affected household welfare negatively as reported by 35% and 28% households, respectively. Livestock deaths and predation are also reported as a major shock identified by 19% households.

Table 2.1.17: Percentage of households who experienced agriculture related shocks

	AR beneficiary	Non-beneficiary	Control	Total
Agriculture related shocks	47.8	47.8	47.3	47.6
Drought or floods	44.7	43.3	44.8	44.5
Strong winds/storms	16.8	17.4	14.5	15.8
Crop disease and pest	16.5	13.4	16.2	15.8
Livestock died or stolen	19.3	16.4	19.9	19.1
Large fall in sale prices for crops	13.1	12.9	8.7	11.0
Large rise in price of food	24.9	26.4	30.0	27.6
Large rise in agricultural input prices	36.5	39.3	33.0	35.3
Severe water shortage	4.9	5.0	6.8	5.8
Loss of land	7.2	6.0	3.9	5.4
Immediate needs of money and selling crop at lowest price	7.4	4.0	3.7	5.0

2.1.10 Anthropometry

Children

This section provides information on physical measurements and health outcomes among children under five. Data are collected on weight and height of targeted informants to construct anthropometric indicators. Using the WHO (2006) guidelines we construct z-score, which refers to the deviation of an individual's measurement from the median value of a reference population divided by the standard deviation of the reference population. Three indicators are used for nutritional assessment of children aged below 59 months, namely stunting, underweight, and wasting. Stunting is measured as height-for-age (haz) being two z-scores below the international reference and is usually an indicator for long term under nutrition. Underweight is measured as weight-for-age (waz) becoming two z-scores below the international reference. Wasting is defined as weight-for-height (whz) falling two z-scores below the international reference indicating a consequence of acute starvation or disease.
Table 2.1.18 presents the prevalence of moderate and severe under nutrition. By definition if the calculated z-scores fall below two standard deviations from the reference population the nutritional status is called moderate undernutrition, whereas the situation is called as severe undernutrition if the z-scores fall further below three standard deviation from the reference population. Overall, 29 percent children suffer from moderate stunting, 9 percent from moderate underweight and 2 percent from moderate wasting. Severe stunting affect about 12 percent of the sample.

Table 2.1.18: Prevalence of moderate and severe under nutrition

	AR beneficiary	Non-beneficiary	control	Total
Moderate undernutrition				
Stunting	0.33	0.26	0.27	0.29
Underweight	0.1	0.09	0.09	0.09
Wasting	0.02	0.02	0.03	0.02
Severe undernutrition				
Stunting	0.15	0.13	0.1	0.12
Underweight	0.00	0.01	0.03	0.02
Wasting	0	0.01	0.01	0.01

Women

Data are collected on nutritional status of women in the reproductive age (15-49 years old) who are currently not pregnant and breastfeeding. The National Institute of Health (NIH) defines weight categories according to BMI (Body Mass Index) rather than traditional height and weight chart. BMI is defined as weight in kilograms divided by the square of one's height in meters. MARBES allows to construct BMI for 634 women in the sample. According to international standard, a BMI below 18.5 indicates underweight, a BMI between 18.5 and 24.9 indicates normal weight, a BMI between 25 and 29.9 indicates overweight, and a BMI above 30 indicates obesity. Table 2.1.19 shows incidence of inadequate BMI in the form of underweight, overweight and obese. Overall, 21 percent suffer from overweight, 8 percent suffer from underweight, and 4 percent is obese.

Table 2.1.19: Incidence of inadequate Body Mass Index

	AR beneficiary	Non-beneficiary	Control	Total
BMI	23.08	22.37	22.41	22.66
No. Obs.	246	88	300	634
Underweight	0.04	0.08	0.11	0.08
Normal	0.72	0.73	0.72	0.72
Overweight	0.24	0.19	0.18	0.21
Obesity	0.04	0.03	0.03	0.04

2.1.11 Conclusion

To summarize the key findings, the household section points out that the majority of the households are Christian, male-headed and involved in crop production. The main crops cultivated in majority of the land are maize, groundnut, soybean and beans. Although average land holding per household is about 2.7 hectares, each households cultivates only an area of about one hectare. Irrigation is extremely rare; less than 1 percent of households reported irrigating their land in rainy season whereas about 10 percent households declared irrigating their land in dry season. Intercropping is widely used practice in the sample with 79 percent households practicing intercropping. Overall, 23 percent households use chemical fertilizer whereas application of manure is common practice concerning about half of the sample households.

In terms of storing the main crops, households mostly use sacks and bags. Granary (which is a safer storage) is used by a quarter of the households in the sample only for storing maize but they are not used for storing other crops. Along with agriculture, households usually raise chicken and goats. About housing condition, majority of the households use mud/ mud brick/ clay as the main materials for wall and floor and roofed with leaves or thatch. About 82 percent households access drinking water from borehole, well and pump. Regarding agricultural shocks, about the half of the surveyed households reported to have suffered from agriculture related shocks in past five years. In particular, droughts and floods severely affected 45 percent of them, followed by large rise in agricultural input prices and price for food. The household section also provides information on anthropometric measures for children and women to assess nutritional status in the sample. MARBES finds that overall 29 percent children suffer from moderate stunting, 9 percent from moderate underweight and 2 percent from moderate wasting. Among women, 21 percent suffer from overweight, 8 percent suffer from underweight and 4 percent is obese.

Next section presents the summary report of the data collected at the community level. The community data summary covers community demography, access to basic services, labor in agriculture, agriculture related problems and solutions, land use and major crops, migration, availability of water resources, and prevalence of shocks.

2.2 MARBES- Community

MARBES successfully conducted community interviews in 54 communities involving 356 informants. Key village and informant characteristics are provided in Table 2.2.1. Average number of informants per village is 6.6 with minimum 5 and maximum 8 per village. Average age of informants is 45 years and all have long standing village tenure, having spent 36 years living in the community on average. Average village population is 1125 with Amosi (6000) and Zaunda (120) being the largest and smallest villages, respectively, among the 54 survey villages (see Figure 2.2.1).

Table 2.2.1: Village and informant characteristics

Item	No. of communities	Mean	Std. Dev.	Min	Max
Elevation in meters	54	924.3	253.5	503.8	1269
Population	54	1125.3	1216.8	120	6000
No. of informants	54	6.6	1.04	5	8
share female	54	0.38	0.14	0.12	0.62
Avg age	54	45.7	6.3	34.8	58.8
Avg years in village	54	36.4	7.9	18.3	52.6

Table 2.2.2: Distribution of informants by position, sex and group

Position in community Male Female	Action		Control		Total		
	Male	Female	Male	Female	Male	Female	Total
Village Chief	16	7	23	1	39	8	47
Village Counselor	15	1	19	2	34	3	37
Village Development Committee Member	11	17	13	14	24	31	55
Area Development Committee Member	2		1	2	3	2	5
ADEO		1	1		1	1	2
Businessman/woman	17	9	18	12	35	21	56
Religious Leader	17	9	13	10	30	19	49
Teacher	11	4	8	9	19	13	32
Other (Specify)	16	17	19	21	35	38	73
TOTAL	105	65	115	71	220	136	356

Average elevation of the surveyed communities is about 924 meters. Among all 356 informants, two in five are female. Table 2.2.2 shows the distribution of informants by sex and research group. Among action villages, 105 males and 65 females participated in the focus group, whereas among control villages, 115 males and 71 females were involved. In terms of the position hold within the community, among the action villages, 23village chiefs, 16 village counselors, 28 village development committee members, 26 religious leaders, and 15 teachers were among the key informants providing information on community characteristics. Among the control villages, 24 village chiefs, 21 village counselors, 27 village development committee members, 23 religious leaders, and 15 teachers were among the key participants for community survey.

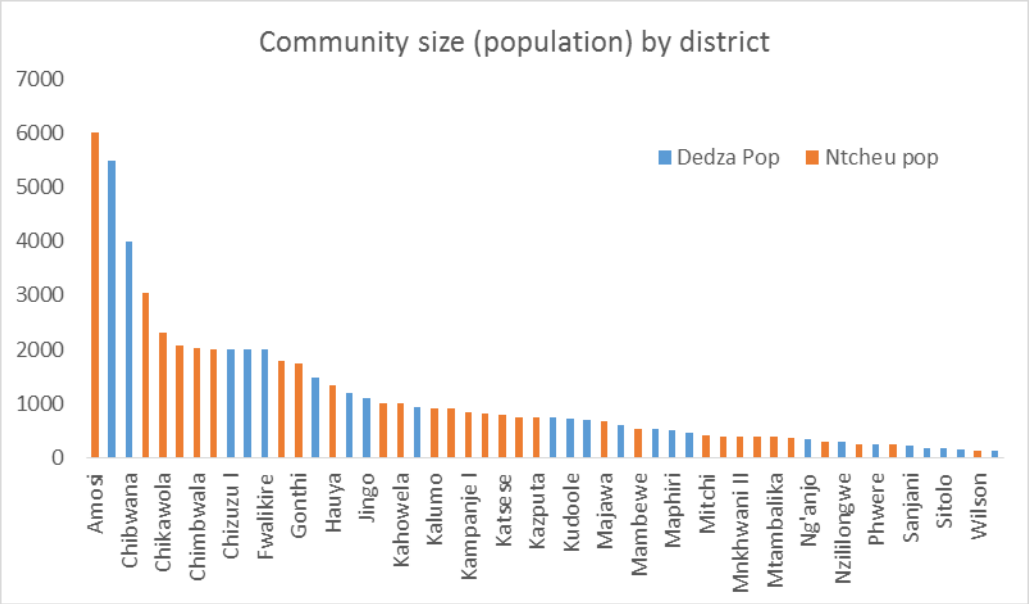

Figure 2.2.1: Community size by district

2.2.1 Access to basic services

Table 2.2.3 provides availability of basic services within each community. All communities have access to primary and secondary school but only 38 communities (18 action and 20 control) have access to pre-primary school. Almost all communities have access to health center, weekly market and milling machine. In contrast, communities face difficulty accessing agricultural and financial services including livestock services. Agricultural extension services are provided in 45 communities (all 25 action and 20 control), bank and financial services in 35 communities (19 action and 16 control), public tap water in only 18 communities (10 action and 8 control), slaughter slab in 28 communities (13 action and 15 control), veterinary clinic only in 31 communities (12 action and 19 control). Further, livestock market available only in 13 communities (7 action and 6 control), but there is no milk collection center available for these communities.

Table 2.2.3: Availability of basic services (n=53)

Basic services	Action	Control	Total
Pre-primary school or nursery school-the nearest	18	20	38
Primary school-the nearest	25	28	53
Secondary school-the nearest	25	28	53
Health center/clinic/hospital	25	28	53
Market (daily)	15	16	31
Market (weekly)	25	28	53
Milling machine-the nearest	25	28	53
Bank, mobile money agent point, SACCO etc.	19	16	35
Extension services	25	20	45
Police station or post-the nearest	20	27	47
Post office-the nearest	22	23	45
Community/Publicly owned tap water-the nearest	10	8	18
Bus stop the nearest	22	20	42
Slaughter slabs	13	15	28
Veterinary centre/clinic	12	19	31
Dip tank	5	8	13
Primary market for Livestock	7	6	13
Milk collection center	0	0	0

The average one way travel time in minutes are shown in Tale 2.2.4. Overall, average travel time to basic services are higher for control communities than for action communities. Pre-primary schools and primary schools are in the close proximity as on average 12 and 21 minutes are needed to reach them, respectively. Secondary schools are less accessible as on average 65 minutes needed to reach them. On average 67 minutes are needed to reach agricultural extension services from the community. Health centers are usually less accessible, take about 77 minutes to reach there. Travel to daily and weekly market and financial institutions take about an hour. By usual mode of transport, service most quickly reachable include public tap water, pre-primary and primary schools (7, 12, and 21 minutes, respectively). Services furthest away include livestock market, post office and bus stop (78, 83, 83 minutes, respectively). For district and EPA headquarters it takes about one and half hours to two hours. Average travel times for various basic services are depicted in Figure 2.2.2.

Table 2.2.4: Average travel time to services in minutes

Basic services	Action	Control	Total
District Headquarters	80	168	124
EPA Headquarters	63	99	81
Pre-primary school or nursery school-the nearest	11	12	12
Primary school-the nearest	17	24	21
Secondary school-the nearest	50	80	65
Health center/clinic/hospital	72	83	77
Market (daily)	55	31	43
Market (weekly)	72	57	64
Milling machine-the nearest	37	18	28
Bank, mobile money agent point, SACCO etc.	43	59	51
Extension services	59	74	67
Police station or post-the nearest	63	82	73
Post office-the nearest	85	80	83
Community/Publicly owned tap water-the nearest	4	9	7
Bus stop the nearest	71	94	83
Slaughter slabs	54	24	39
Veterinary center/clinic	47	61	54
Dip tank	26	99	63
Primary market for Livestock	71	86	78

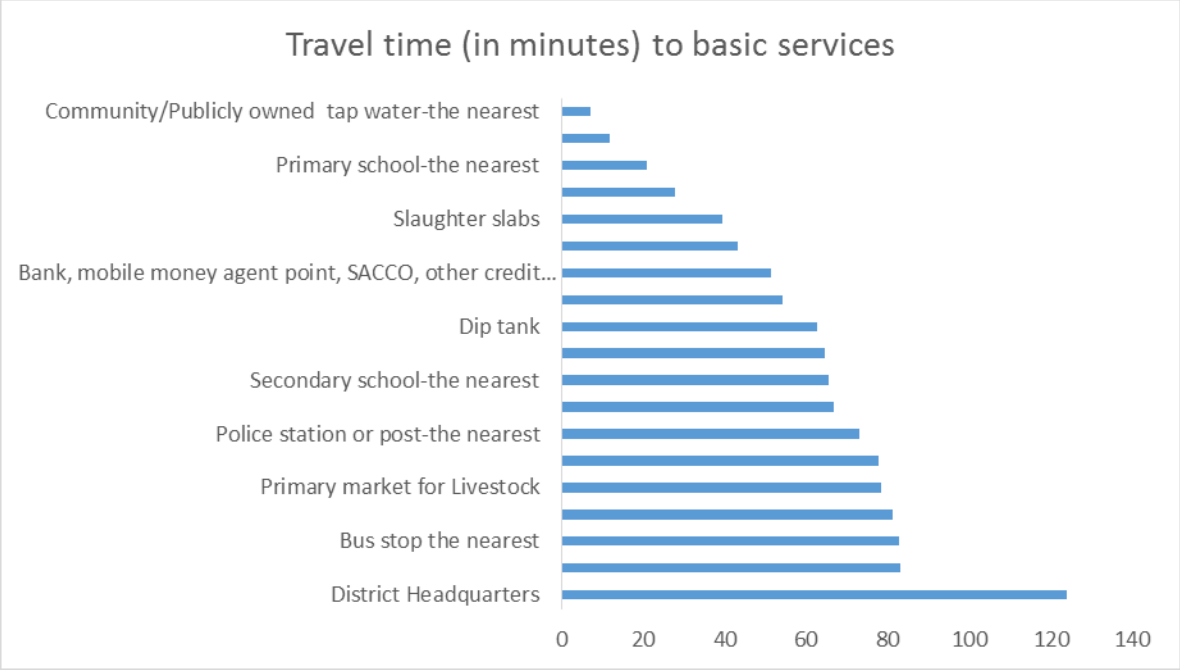

Figure 2.2.2: Travel time in minutes to access services

Further detailed information was collected in relation to services provided by extension offices. Table 2.2.5 reports the number of communities (by research group) where specific agricultural services are provided. Frequently provided services offered by agricultural extension offices are clearing, ploughing, planting, compost making and fertilizer application, for which on average about 43 communities reported availability of these services. On the contrary, less frequent

services are livestock management, irrigation, weeding and harvest for which on average 32 communities reported receiving these services from extension offices.

Table 2.2.5: Availability of agricultural extension service (n=53)

Extension services	Action	Control	Total
Clearing	25	18	43
Ploughing	25	19	44
Planting	26	18	44
Compost Making	25	18	43
Application of fertilizer	25	17	42
Application of herbicide/ fungicide/pesticide	20	14	34
Weeding	21	15	36
Irrigation	17	16	33
Harvest	22	15	37
Livestock management	19	12	31

2.2.2 Gendered breakdown of labor in agricultural activities

Community level information on labor allocation for agricultural activities was gathered. Table 2.2.6 presents the gendered breakdown of various labor use by type (family, hired and communal). Agriculture within these communities remain a family run system. Labor use for various agricultural activities are skewed heavily toward family members and hired labor, with communal labor being the least preferred option. Main activities such as planting, clearing and fertilizer application involve most family members including male, female and children. Herbicide, fungicide and pesticides are mostly applied by male and female members of the family, children are rarely used for these activities, whereas for livestock management children (27) are employed more than male members (25) of the family. In regards to irrigation, on average 32 communities declared that male and female are employed whereas only 24 communities employ children. For harvest also more male and female are employed compared to children. Compost making also attracted more male and female member of the family than children.

Lesser number of communities reported the use of hired labor for various agricultural activities. Hired labors are employed more for ploughing and fertilizer application compared to other activities. Compost making and herbicide application are not done by hired labors. Female labors are not hired for livestock management, livestock related activities are usually considered as family activity. Significant number of communities reported the use of hired child labor for ploughing (27), clearing (24) and fertilizer application (24).

Table 2.2.6: Gender breakdown of labor in agricultural activity

Agricultural activity	Action			Control			Total		
	Male	Female	Children	Male	Female	Children	Male	Female	Children
Family labor									
Application of fertilizer	23	25	24	16	17	16	39	42	40
Herbicide/ fungicide/pesticide	20	16	3	13	12	3	33	28	6
Clearing	24	25	23	18	18	14	42	43	37
Compost making	23	25	11	18	18	10	41	43	21
Harvest	22	22	20	15	15	13	37	37	33
Irrigation	16	16	13	16	16	11	32	32	24
Livestock management	14	19	18	11	12	9	25	31	27
Planting	25	26	25	18	18	17	43	44	42
Ploughing	25	25	22	19	19	15	44	44	37
Weeding	21	21	20	15	15	14	36	36	34
Hired labor									
Application of fertilizer	17	17	11	14	14	13	31	31	24
Herbicide/ fungicide/pesticide	6	2	1	8	4	2	14	6	3
Clearing	18	18	14	15	15	10	33	33	24
Compost making	7	5	1	4	2	1	11	7	2
Harvest	17	17	12	12	12	11	29	29	23
Irrigation	8	5	5	10	7	4	18	12	9
Livestock management	9		11	7		5	16		16
Planting	15	16	11	14	15	9	29	31	20
Ploughing	19	18	15	15	15	12	34	33	27
Weeding	15	15	13	12	12	9	27	27	22
Communal labor									
Application of fertilizer	6	7	3	2	2	2	8	9	5
Herbicide/ fungicide/pesticide									
Clearing	3	9	2	1	8	5	4	17	7
Compost making	1	1	1	1			2	1	1
Harvest	8	11	7	3	9	1	11	20	8
Irrigation	4	1					4	1	
Livestock management	7		7			2	7		9
Planting	2	6	5		1		2	7	5
Ploughing	5	12	5	3	10	6	8	22	11
Weeding	9	12	4	2	8	2	11	20	6

Use of communal labor is usually practiced less in these communities. For harvest, ploughing and weeding, communal labor are used greatly used these communities. Compared to male and children, female are employed more for communal agricultural activities. For example, for clearing 17 communities reported use of female communal labor whereas only 4 and 7 communities reported use of male and children labor. For harvest 20 communities reported use of female labor while only 11 and 8 communities employed male and children labor, respectively. Similar trends are also revealed in case of ploughing and weeding activities.

2.2.3 Agricultural problems and solutions

The community informants were asked about the major agricultural problems faced by the households in the community. Table 2.2.7 reports number of communities that faced major agricultural problems according to their importance. By far the most important problem as reported by 39 communities (21 in action site and 18 in control site) is the high price of agricultural inputs. Next identified problems are drought, shortage of agricultural inputs, and unfavorable weather condition as identified by 3 communities each. Long distance to output market is also a major problem reported by 2 communities. Among the second most important agricultural problems faced by the households, unfavorable weather condition is very crucial for 5 action villages and 4 control villages. High price of agricultural inputs is again very serious problem for 2 action and 6 control villages. Low soil fertility is also among the major agricultural problems reported by 5 communities. Other important agricultural problems faced by the households are fluctuating output price, disease, shortage of agricultural inputs, and unfavorable weather condition as mentioned by 4 communities each as their second most important agricultural problems.

Table 2.2.7: Major agricultural problems

	Action	Control	Total
1st important			
Shortage of agricultural inputs	2	1	3
High price of agricultural inputs	21	18	39
Drought	0	3	3
Unfavorable weather condition	1	2	3
Long distance to output market	1	1	2
Fluctuating output price	0	1	1
Limited access to grazing land	1	0	1
Lack of information/limited knowledge	0	1	1
Limited access to credit	0	1	1
2nd important			
Shortage of agricultural inputs	4	0	4
High price of agricultural inputs	2	6	8
Long distance to agricultural input markets	1	1	2
Low soil fertility	2	3	5
Limited access to farming land/small land size	2	2	4
Poor quality of seeds	0	1	1
Crop pests and diseases	1	0	1
Drought	0	1	1
Unfavorable weather condition	5	4	9
Long distance to output market	1	3	4
Fluctuating output price	2	2	4
Disease	1	3	4
Limited access to veterinary service	2	1	3
Lack of information/limited knowledge	0	1	1
Theft	1	0	1
Other problems	2	0	2

The informants were also asked about the major strategies they used in the community to solve the above mentioned agricultural problems. Table 2.2.8 shows number of communities that took various major strategies against the problems. By far the most important strategy taken by the community is the adjustment of input use (e.g., seeds and fertilizer) to conditions as reported by 16 action and 14 control communities. This is consistent with the most important problem of high price of agricultural inputs. 8 communities declared adopting other interventions to deal with the problems in agriculture. However, a significant number of communities (3 action and 4 control) reported no action against the problems. Among the second most important strategies to overcome the problems, most (8 action and 8 control communities) communities reported taking no action. Adjusting input use and implementing other intervention are mentioned by 7 communities each as major strategies to cope with the problems.

Table 2.2.8: Most important strategies against the problems

	Action	Control	Total
1st strategy			
Increase household's labor share	2	1	3
Participate in labor exchanges	0	1	1
Adjust input use (e.g., seeds and fertilizer) to conditions	16	14	30
Use irrigation	1	1	2
Use pesticides	0	1	1
Sale produce in piecemeal	0	1	1
Ask advice from family/friends/extension agents	0	1	1
Other interventions	4	4	8
Took no action	3	4	7
2nd strategy			
Increase household's labor share	0	1	1
Adjust input use (e.g., seeds and fertilizer) to conditions	3	4	7
Rent/hire/share /purchase agricultural land	2	2	4
Borrow/rent/hire farm equipment	1	0	1
Use irrigation	0	1	1
Build soil conservation structure	2	1	3
Postpone sale of produce	1	0	1
Sale produce in piecemeal	1	4	5
Hire transport (alone or as a group)	1	0	1
Sell/slaughter animals	1	2	3
Ask advice from family/friends/extension agents	0	1	1
Other interventions	4	3	7
Took no action	8	8	16

2.2.4 Land use and ownership

Table 2.2.9 presents land use pattern in the community. Overall, 45 percent of total land in the communities is under cultivation. The share of cultivable land varies greatly across communities with a range from 10 percent to 85 percent. On average, 31 percent of the total is used as residential land. The remaining lands are devoted to a combination of forestland, wetland, business and other purposes. Proportion of average community land use pattern is depicted in Figure 2.2.3. The cultivable lands are most widely used for individual (household) cultivation accounting for about 72 percent of land under cultivation. The residual lands are devoted to a combination of communal cultivation, grazing for livestock, and other purposes. There is no report of cultivable lands used for agro-business by outsiders in the sample communities.

Table 2.2.9: Total and cultivable land use in the community

Total land use	Mean	Std. Dev.	Min	Max
Cultivable land	44.5	18.3	10	85
Forest land	6.2	7.8	0	38
Wetland	7.5	8.5	0	40
Residential land	31.3	12.7	6	64
Business	2.5	5.0	0	24
Other	7.9	7.3	0	32
Cultivable land use				
Communal cultivation	2.6	6.7	0	32
Individual (household) cultivation	72.7	25.0	24	100
Agro-business by outsiders	0.0	0.0	0	0
Grazing land for livestock	4.9	7.3	0	30
Other	2.9	5.2	0	20

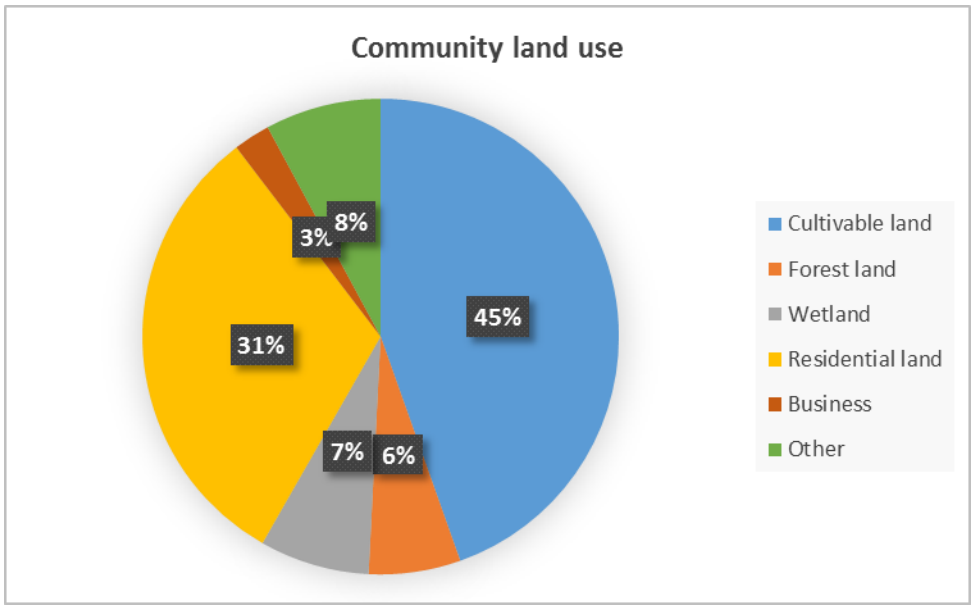

Figure 2.2.3: Community land use

Table 2.2.10 presents the land ownership and inheritance of land in the community. 47 communities reported land ownership by both men and women. In 7 communities however, only women are entitled to own land. This is unusual finding compared to other sub-Saharan African countries where persistence of gender inequality is observed in the sense that access to land is privileged by men only. To further investigate the gender dimension of land ownership, the 47 communities where both men and women can own land, are inquired about inheritance of land. Majority of such communities (10 action and 16 control communities) reported that wife can inherit husband's land after his death. On the other hand, only 3 communities reported that husband can inherit wife's land after her death.

Table 2.2.10: Land ownership and inheritance of land

Gendered land ownership	Action	Control	Total
Only women	3	4	7
Men and women	23	24	47
Inheritance of land			
Husband inherit wife's land	1	2	3
Wife inherit husband's land	10	16	26

2.2.5 Main crops

The main crops cultivated by the communities are summarized in table 2.2.11. Consistent with the finding from household survey we see that all communities grow maize. Groundnuts are cultivated in 52 communities, soybeans in 33, beans in 23, tobacco in 15, and cow-peas in 13 communities.

Table 2.2.11: Main crops in the community

Main crop cultivated	Action	Control	Total
Maize	26	28	54
Groundnut	25	27	52
Soybean	20	13	33
Bean	7	16	23
Tobacco	9	6	15
Cow-peas	6	7	13
Cotton	3	2	5
Finger millet	3	1	4
Pearl millet	1	2	3
Sweet potato	1	1	2
Cassava	0	2	2
Rice	0	1	1
Bambara nuts	1	0	1
Tomatoes	0	1	1
Onion	1	0	1
Irish potato	0	1	1

The proportion of cultivated land dedicated to various crops are presented in table 2.2.12 by disaggregating the data at the district level. The data confirm that maze is by far the leading crop grown in those communities accounting for more than half of the available cultivated land, with a wide variation of the percentage ranging from 20 to 95 percent. The proportion of cultivated lands by main crops by district are depicted in Figure 2.2.4. The district level pattern of the proportion of land by crops are similar. However, in Ntcheu the proportion of land devoted by maize is higher on average than that of Dedza. Groundnuts are important secondary crop, accounting for about 14 percent of total cultivated land in the community. The next highest proportion of land is devoted to Soybeans that accounts for 7.5 percent on average.

Table 2.2.12: Percentage of cultivated land devoted to various crops by district

% share of main crops	Obs	Mean	Std. Dev.	Min	Max
Dedza					
Maize	24	51.7	21.3	20	82
Beans	24	5.6	7.3	0	30
Irish potatoes	24	1.2	2.9	0	10
Groundnuts	24	14.3	7.3	2	30
Soybeans	24	7.5	6.4	0	22
Ntcheu					
Maize	30	55.8	19.5	30	95
Beans	30	5.4	5.5	0	20
Irish potatoes	30	0.5	1.4	0	6
Groundnuts	30	14.4	5.4	3	26
Soybeans	30	7.5	3.6	1	12

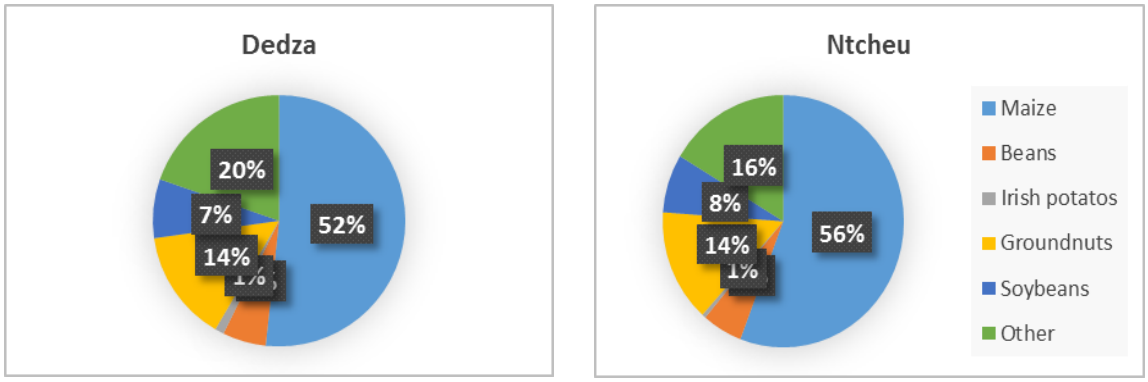

Figure 2.2.4: Proportion of cultivated land dedicated to crops by district

2.2.6 Farmer cooperatives

Table 2.2.13 shows households' involvement with cooperatives. Out of 54 communities 35 reported presence of farmer cooperatives in the village. On average there are 2.5 cooperatives in each village, with an average number of 42 farmers per cooperative. The most important activity in the cooperatives is sharing knowledge as highlighted by 20 communities, followed by physical activities on farm reported by 7 communities, and group credit in 6 communities. Among the second most important activities, knowledge sharing, physical activities on farm and group credit are highlighted by communities.

Table 2.2.13: Farmer cooperatives

	Action	Control	Total
Presence of farmer cooperatives	22	13	35
Avg. no. of cooperative	2.63	2.3	2.5
Avg. no. of farmers per cooperative	47.7	32.4	42
Most important activity			
Sharing knowledge	13	7	20
Sharing equipment	0	1	1
Physical activities on farm	7	0	7
Irrigation	0	1	1
Group credit	2	4	6
Second most important activity			
Sharing knowledge	8	3	11
Buying inputs	0	1	1
Physical activities on farm	8	2	10
Group credit	5	3	8
Selling output	0	2	2
Third most important activity			
Sharing knowledge	1	1	2
Buying inputs	1	0	1
Sharing equipment	3	0	3
Physical activities on farm	1	1	2
Irrigation	0	1	1
Group credit	2	0	2
Storing crops	2	0	2
Selling output	1	2	3

2.2.7 Prevalence of migration

Table 2.2.14 reports that in 19 communities people permanently move out, with average number of 4.3 percent of the community population permanently move out. In terms of permanent inward migration, people in 37 communities people moved in, with an average number of 4.1 percent of the population migrated in last 12 months.

Table 2.2.14: Prevalence of migration (n=54)

	Action	Control	Total
Communities where people permanently migrated out in last 12 months	10	9	19
Average % of people	3.4	5.3	4.3
Communities where people permanently migrated into in last 12 months	19	18	37
Average % of people	2.4	5.8	4.1

2.2.8 Availability of water sources

MARBES collected information on main water sources available in the communities (see Table 2.2.15). Borehole or well are available in most communities (48 communities), lake, pond, river, reservoir, or streambed are available in 37 communities, whereas piped water is available in 17 communities. Further among the 48 communities where borehole/ well are available, only in 42 communities such water is available for private use, whereas among the 17 communities where piped water is available, in 16 communities such water is available for private use. 100 percent population in the community relies on rain, whereas 91 percent population relies on borehole or well. About 75 percent population depends on piped water and about 54 percent population relies on lake, pond, river, reservoir, or streambed.

Table 2.2.15: Availability of water sources (n=54)

Water source	Action	Control	Total
Availability			
Piped water	9	8	17
Borehole or well	23	25	48
Lake, pond, river, reservoir, or streambed	20	17	37
Other	1		1
Private use			
Piped water	9	7	16
Borehole or well	20	22	42
Other	1		1
% of population relying on			
Rain	100	100	100
Piped water	98	49	75
Borehole or well	84	98	91
Lake, pond, river, reservoir, or streambed	61	46	54
Other	5		5

Prevalence of shocks

Table 2.2.16 shows the occurrence of shocks in last agricultural season (2013) and percentage of households affected by the shocks. In the cropping season prior to the survey, the most important shock was large rise in price of food and large rise in crop input prices both occurring in all the communities in the sample and affecting on average about 96 percent of households. It follows outbreak of livestock disease or pest taking place in 51 communities and affecting on average 64 percent of households. Next comes large fall in crop sale prices and theft, vandalism and robberies taking place in 47 and 46 communities affecting about 83 and 28 percent of households in the communities. Figure 2.2.5 shows the share of household affected by various shocks.

Table 2.2.16: Prevalence of shocks

	Action	Control	Total
No. of communities affected during last cropping season (2013)			
Drought or flood	18	20	38
Strong winds/storm	17	20	37
Crop disease or pest	22	20	42
Outbreak of livestock disease or pest	24	27	51
Large fall in crop sale prices	25	22	47
Large rise in price of food	26	28	54
Large rise in crop input prices	26	28	54
Loss of land	5	8	13
Political, tribal, and farmers' livestock conflict	3	6	9
Theft, vandalism, robberies	21	25	46
Fire	7	7	14
Other	1	4	5
% of households affected by shocks			
Drought or flood	59.8	85.8	73.5
Strong winds/storm	56.4	53.6	54.9
Crop disease or pest	54.5	73.5	63.5
Outbreak of livestock disease or pest	62.0	65.1	63.6
Large fall in crop sale prices	86.0	80.0	83.2
Large rise in price of food	93.9	97.1	95.6
Large rise in crop input prices	94.2	98.0	96.2
Loss of land	14.4	44.8	33.1
Political, tribal, and farmers' livestock conflict	10.3	11.5	11.1
Theft, vandalism, robberies	24.0	32.6	28.7
Fire	5.9	3.4	4.6
Other	100.0	49.3	59.4

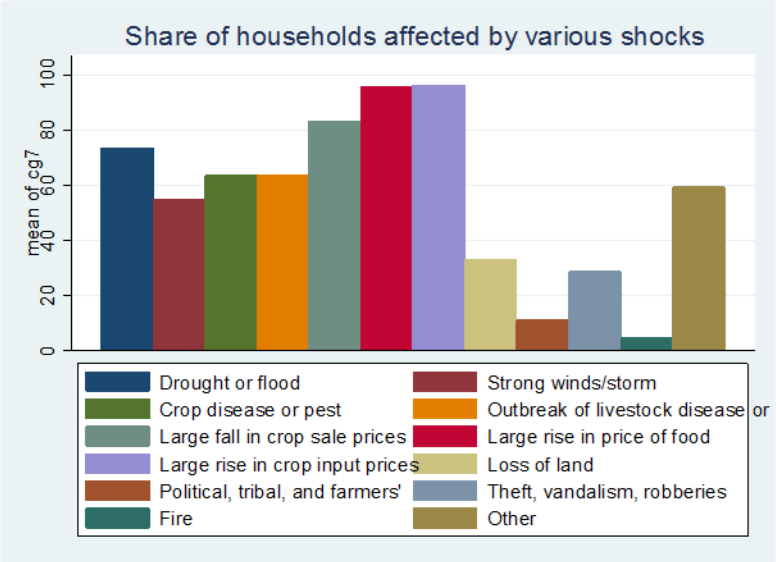

Figure 2.2.5: Overall share of households affected by various shocks

2.2.9 Conclusion

Community level data show that access to primary education is available in all 54 surveyed communities and the primary schools are in close proximity as on average 21 minutes needed to reach them. Although health facilities are available in all communities they are usually less accessible as about 77 minutes travel on average is required to reach them. Overall, the average travel time to basic services are found to be higher for control communities compared to action communities.

Labor use in the communities for various agricultural activities are skewed heavily toward family members and hired labor, with communal labor being the least preferred option. The main agricultural activities such as planting, clearing and fertilizer application involve most family members including male, female and children. For application of herbicide, fungicide and pesticides children are rarely used whereas for livestock management children are more involved in a family. Community data show that overall 45 percent of the total land in the communities is cultivable which confirms the picture emerging from the household level data. Lands can be owned by men and women and wife can inherit husband's land after death. The community data also confirm that the main crops in the area are maize, groundnut, soybean and beans. Maize is by far the leading crop grown in the surveyed communities accounting for more than half of the available cultivated land.

Regarding the most important agricultural problems, high price of agricultural inputs is by far the most important problem reported by most communities. Consistently, the most important strategy taken by the communities is adjustment of input (seeds and fertilizer) use. Farmer cooperatives are present in most communities and are used primarily for sharing knowledge. In terms of the most serious shock to agriculture, community data reinforce that the shortage of inputs and their high prices cause the most serious negative shock to agriculture.

3 Concluding comments

MARBES was successfully conducted in 54 communities (28 control and 26 intervention) selected for AR evaluation study. The household dataset covers 1,149 households where the survey tool was developed to collect information on various socioeconomic variables such as demography, agricultural land characteristics, production and inputs, storage facility, livestock ownership, dwelling characteristics, agricultural related shocks, and children and women anthropometry. The community tool was designed to collect information on community demography, access to basic services, labor in agriculture, agriculture related problems and solutions, land use and major crops, migration, availability of water resources, and prevalence of shocks.

Both household and community survey data analysis reveal that crop production is the primary economic activity of the surveyed households and communities. Average household level land size in the sample is about 2.7 hectares but the cultivable land holding is about one hectare per household. The main crops cultivated in the area are maize, groundnut, soybean and beans. Most households practice mixed farming with prevalence of chicken raising in the households. The findings from the community interviews in all 54 villages confirm the general findings out of household survey data. Total cultivable land in average community is 45% which confirms the average percentage of cultivable land from the household data. The community data also confirm that the main crops in the area are maize, groundnut, soybean and beans. In terms of the most serious shock to agriculture, community data reinforce that the shortage of inputs and their high prices cause the most serious negative shock to agriculture.

The data presentation of the household level variables by AR beneficiary, non-beneficiary and control households and their equality of means tests show some clear differences between AR beneficiary, non-beneficiary and control households. Compared to non-beneficiary and control households, AR beneficiary households present larger household size, higher average adult years of education, more likely to be married or cohabiting, and higher likelihood to be male headed household. AR beneficiary households are also better off than non-beneficiary and control households in terms of average per capita land size at household level, irrigation in dry season, and travel time to the nearest parcel with usual mode of transport.

With the present evaluation design along with both household and community level data MARBES can be used to evaluate overall effectiveness of AR program in Malawi. The baseline dataset can facilitate monitoring and devaluation information system. The MARBES can facilitate research on characterization of complex production system, socioeconomic modeling and household decision making. Finally, these detailed baseline household information can facilitate deeper research integration. For example, the investigation on mechanics of technology adoption can be carried out by conducting follow up survey and tracking technology use and associated constraints of adoption. Africa RISING project has been introducing various improved technologies through trials in the field. But it is not clear whether small holder farmers would be willing to pay for these technologies, and what factors determine their informed demand for technologies. Exploring more on willingness to pay and desired demand by the farmers can contribute to sustainability of the AR interventions. Moreover, creating a panel data with follow up surveys can help overcome technical difficulties of identification of program level impacts.

4 References

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5 Appendix

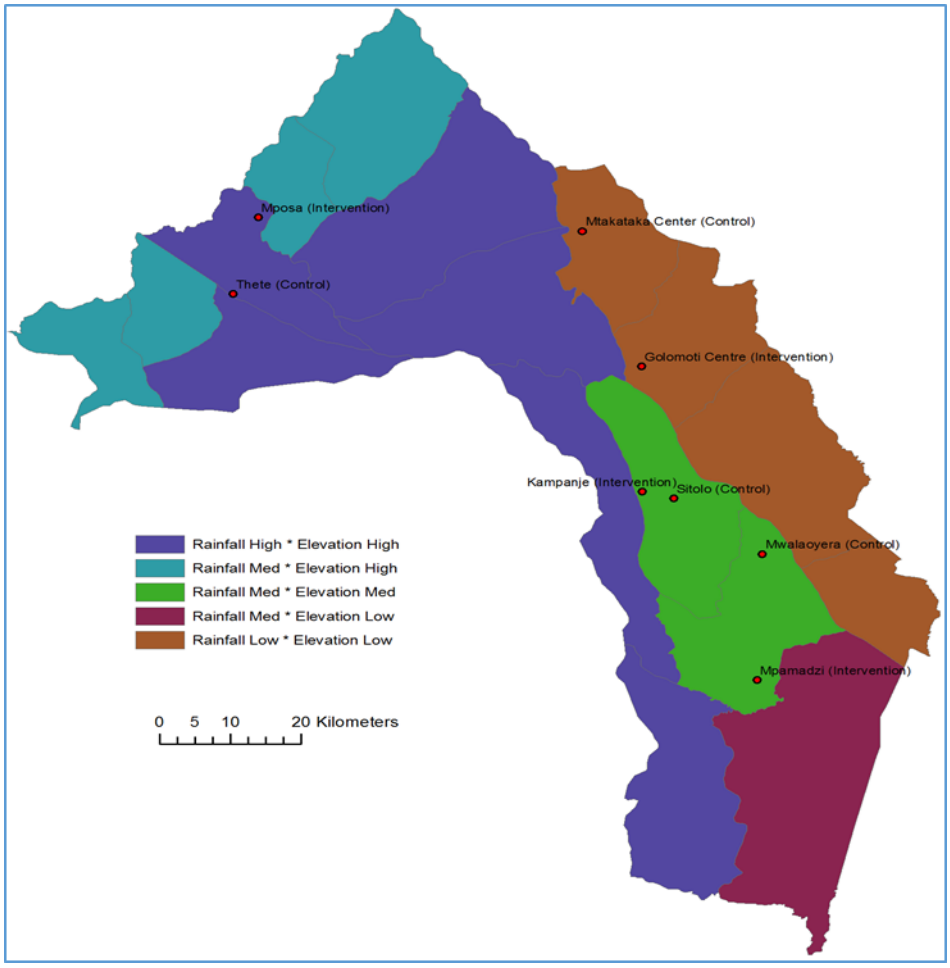
Appendix 1 (Table A1): AR Malawi innovations (2012/13 cropping season)

District	EPA	Innovations				
		Maize	Cowpea	Pigeon pea	Groundnut	Soybean
Dedza	Linthipe	PAN 53	Sudan 1	Mwaiwathu alimi	CG7	Makwacha
		DKC 9089	IT82E-16	Sauma	Nsinjiro	Nasoko
	Golomoti	SC403	Nkanakaufiti	Sauma	Nsinjiro	Nasoko
		DKC 8053	Nkanakaufiti	Mwaiwathu alimi	CG7	Makwacha
Ntcheu	Kandeu	SC627	Sudan 1	Mwaiwathu alimi	Nsinjiro	Makwacha
		DKC 8053	IT82E-16	Sauma	CG7	Nasoko
	Nsipe	SC627	Sudan 1	Mwaiwathu alimi	CG7	Makwacha
		DKC 8053	IT82E-16	Mwaiwathu alimi	Nsinjiro	Nasoko

Source: AR Malawi

Appendix 2 (Table A2): Candidate data layers considered for characterization of Dedza and Ntcheu districts

Data layer	Spatial resolution	Year	Source
Population density	1 km^2	2000	CIESIN
Agro-Ecological Zone	~10km^2		IIASA
Precipitation	50 km^2	long term (> 50 years) average	CRU
	1 km^2	long term (> 50 years) average	WorldClim
	100 km^2	long term (> 50 years) average	NASA POWER
	50km^2	long term (> 50 years) average	GPCC
	1km^2	long term (1976-2008) average	Interpolated from national weather station
Elevation	1 km^2		USGS
Slope	1 km^2		USGS
Farming systems	shape file		John Dixon (2012 version)
Market access	1 km^2	2000	HarvestChoice
Length of growth period	~10km^2	long term (> 50 years) average	IIASA
Maize harvested area	~10km^2	2000	HarvestChoice



Appendix 3 (Figure A1): Final data layers and their classification

Appendix 4 (Table A3): MARBES survey tool-household

Module	Objective: gather data on…
Household members	educational attainment, marital status, and primary/secondary occupation of household member
Labor	employment, earnings, unemployment, and seasonality in employment
Health	visited health facilities, on how much was spent on any illnesses/injuries,
Agricultural land	land ownership, land and soil characteristics, and water sources (at parcel-level)
Crop inputs (conservation)	farming and soil conservation practices. Data will be collected at a parcel-plot level.
Crop inputs (cost)	seeds, pesticides, fertilizer, and non-labour expenses the household used. Data will be collected at a parcel-plot level.
Crop inputs (labor)	labour input on crops grown on each plot during the rainy and dry seasons. Data will be collected on how many person-days were used for different activities for each crop grown on a plot. Person days are calculated as the number of workers times the number of days they worked
Crop inputs (seed)	seeds were used by cropping season.
Crop production	crops grown on each plot and the different varieties of the crops.
Crop sale	crop sale
Crop storage	storage methods used by households and how effective the methods are/have been. Questions will be asked about all the crops the household grew in the previous cropping season.
Livestock ownership	the number of the different livestock types (disaggregated by local and improved) owned by the household at the time of data collection and during the preceding 12 months.
Livestock feed/water	sources of food and drinking water for different livestock categories
Challenges	agriculture-related problems faced by the household and coping strategies
Extension	interaction with agricultural extension agents and participation in Africa RISING
Other income	non-agricultural income activities that the household has used to acquire/increase the household income in the past 12 months
Credit	access to and use of credit
Housing	facilities the household has inside the home
Welfare & Food security	food security and seasonality in terms of access food (at household level and selected demographic groups)
Food consumption	food expenditure on food, including cereals, starches from roots, sugar, pulse, nuts and seeds, vegetables, fruits, meat, meat products, and fish, milk and milk products, oil and fats, spices and other foods, beverages, and wild fruits, vegetables and meat products
Non-food expenditure	non-food expenditures. Data on food and non-food expenditure will be used to construct a measure of poverty
Shocks	various types of shocks the household mighty have experienced over the past five years and coping strategies
Women anthropometry	nutritional outcomes of women 15-49 years
Child anthropometry	nutritional outcomes of children 0-59 months old

Appendix 5 (Table A4): MARBES survey tool-community

Module	Objective: Gather community-level data on…
Basic services	access to basic services
Extension	agricultural labor, extension services, and agricultural problems
Land	land use
Demographics	organizations, labor movement, major crops provides, and amount and fluctuation of rain water
Water, shocks, and food	access to water, shocks, and food consumption
Local units and prices	metric conversion of local measurement units and crop price data

Appendix (Table A5): Distribution of households in control communities

EPA	Section	Village	Control	Total
Mtakataka	Mtakataka Center	Fwalikire	20	20
Mtakataka	Mtakataka Center	Chidzondo	20	20
Mtakataka	Mtakataka Center	Kakhome I	21	21
Mtakataka	Mtakataka Center	Kautsile	20	20
Mtakataka	Mtakataka Center	Kudoole	19	19
Mtakataka	Mtakataka Center	Chikawola	19	19
Mtakataka	Mtakataka Center	Manyika	21	21
Mtakataka	Mtakataka Center	Tseka	21	21
Kandeu	Sitolo	Kambadya	21	21
Kandeu	Sitolo	Majawa	22	22
Kandeu	Sitolo	Sitolo	17	17
Kandeu	Sitolo	Zaunda	18	18
Nsipe	Mwalaoyera	Chilumo	19	19
Nsipe	Mwalaoyera	Chimwala	13	13
Nsipe	Mwalaoyera	Sanjani	21	21
Nsipe	Mwalaoyera	Jingo	14	14
Nsipe	Mwalaoyera	Hauya	20	20
Nsipe	Mwalaoyera	Kahowela	18	18
Nsipe	Mwalaoyera	Mnkhwani	20	20
Nsipe	Mwalaoyera	Mnkhwani II	20	20
Nsipe	Mwalaoyera	Pendanyama	19	19
Lobi	Thete	Chizuzu I	21	21
Lobi	Thete	Kabinda II	20	20
Lobi	Thete	Gogo	21	21
Lobi	Thete	Maphiri	19	19
Lobi	Thete	Mafuko	19	19
Lobi	Thete	Chimbwala	21	21
Lobi	Thete	Mambewe	20	20
Total			544	544

Appendix (Table A6): Distribution of households in intervention communities

EPA	Section	Village	AR Beneficiary	Non-beneficiary	Total
Golomoti	Golomoti Centre	Kalumo	25	6	31
Golomoti	Golomoti Centre	Msamala	30	6	36
Golomoti	Golomoti Centre	Pitala	27	6	33
Golomoti	Golomoti Centre	Wilson	18	6	24
Linthipe	Mposa	Chibwana	3	18	21
Linthipe	Mposa	Mbidzi	21	16	37
Linthipe	Mposa	Mkuwazi	31	12	43
Linthipe	Mposa	Ng'anjo	13	18	31
Linthipe	Mposa	Phwere	3	17	20
Kandeu	Kampanje	Katsese	28	7	35
Kandeu	Kampanje	Kampanje I	15	7	22
Kandeu	Kampanje	Kampanje II	25	9	34
Kandeu	Kampanje	Kazputa	3	8	11
Kandeu	Kampanje	Dauka	42	8	50
Kandeu	Kampanje	Gonthi	18	7	25
Kandeu	Kampanje	Khomba	2	5	7
Kandeu	Kampanje	Mitchi	6	5	11
Nsipe	Mpamadzi	Amosi	32	7	39
Nsipe	Mpamadzi	Champiti	3	6	9
Nsipe	Mpamadzi	Gwauye	5	6	11
Nsipe	Mpamadzi	Hiwa	14	6	20
Nsipe	Mpamadzi	Malinda	7	3	10
Nsipe	Mpamadzi	Njolomole	9	5	14
Nsipe	Mpamadzi	Mtambalika	3		3
Nsipe	Mpamadzi	Ngaipite	11	1	12
Nsipe	Mpamadzi	Nzililongwe	10	6	16
Total			404	201	605